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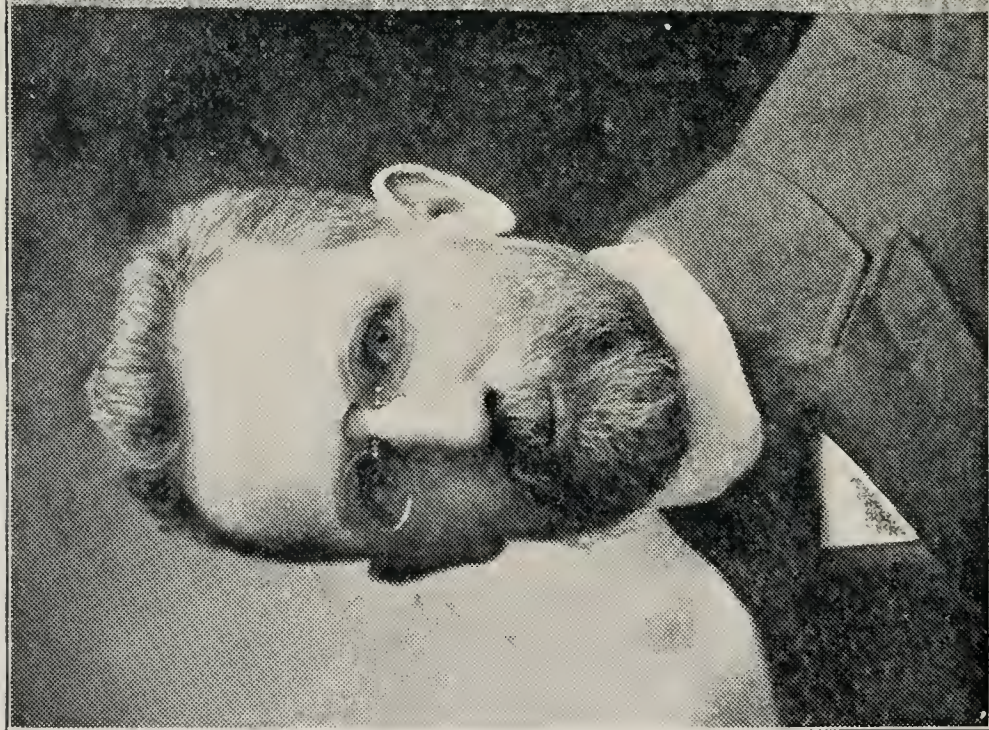
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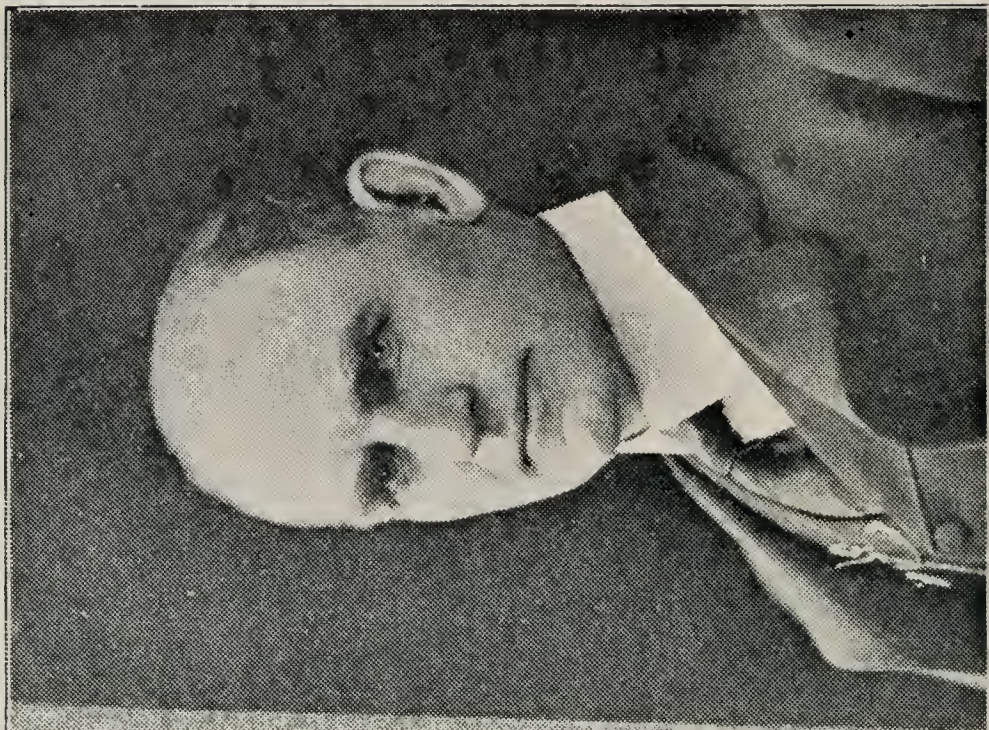
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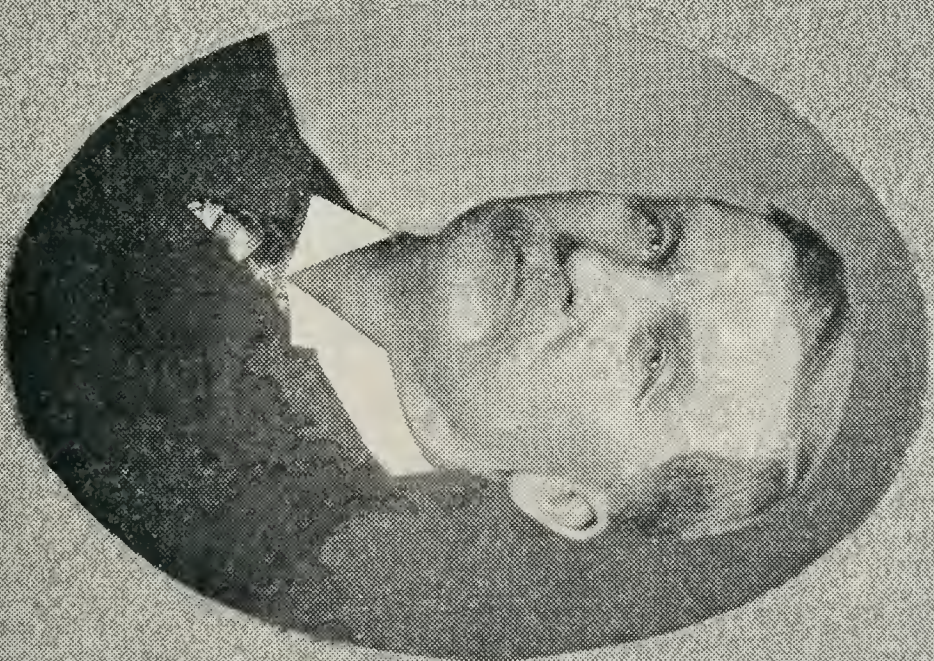
W. W. WYLIE, BOZEMAN, MONT.



JOHN M. ROBINSON, BOZEMAN, MONT.



J. E. MORSE, DILLON, MONT.



I. D. O'DONNELL, BILLINGS, MONT.

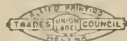
THIRD ANNUAL REPORT
OF THE
MONTANA
FARMERS' INSTITUTES

for the year
Ending November 30, 1904

AUTHORIZED BY
The Administrative Board of
Farmers' Institutes

Edited by F. B. LINFIELD, Secretary

"INDEPENDENT PUBLISHING COMPANY, HELENA, MONTANA."



Letter of Transmittal.

Bozeman, Mont., March 1, 1905.

To His Excellency, Joseph K. Toole,
Governor of Montana:

Dear Sir—I have the honor to transmit herewith the Third Annual Report of the Montana Farmers' Institutes.

Very respectfully,

F. B. LINFIELD,

Secretary.

Montana Board of Administration of Farmers' Institutes.

Gov. J. K. TooleEx-Officio
F. B. Linfield, Director Montana Experiment Station..Ex-Officio
T. C. Power, President Wool Growers' Association.....Helena
J. M. Holt, President Wool Growers' Association....Miles City
W. B. Harlan, President Horticultural Society.....Como
F. L. Benepe, Pres. Registered Cattle Breeders' Asso...Bozeman
E. N. Brandigee, Pres. State Board of Horticulture.....Helena
W. M. Wooldridge, Pres. State Agricultural Society..Hinsdale

Officers of the Board.

W. B. HarlanPresident
F. B. LinfieldSecretary and Superintendent

Executive Committee.

Gov. J. K. TooleHelena
W. B. HarlanComo
F. B. LinfieldBozeman

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State Law Providing for Farmers' Institutes as Amended by the
8th Legislative Assembly.

Be it Enacted by the Legislative Assembly of the State of Montana:

Section 1. That Section 1 of said Act be and the same is hereby amended so as to read as follows:

Section 1. The Board of Administration of Farmers' Institutes, as provided for in this Act, shall consist as follows:

The Governor of the State and the Director of the Montana Experimental Station, both of whom shall be ex-officio members, and the presidents of the following named organizations:

The Montana Registered Cattle Breeders' Association, the Montana Woolgrowers' Association, The Montana Livestock Association, The Montana Horticultural Society, The Montana State Board of Horticulture, The Montana Agricultural Association and the Montana Dairymen's Association, when these last two shall have been duly organized. Members of such Board of Administration shall be designated the "Directors of the Montana Farmers' Institutes," and shall be authorized to hold Institutes for the instruction of the citizens of this State in the various branches of agriculture, and shall prescribe such rules and regulations as they may deem best for organizing and conducting the same. Such Institutes shall be held at least once in each county in each year and at such times and places as the directors may designate; provided, the requirements of the Board of Administration have been complied with, such as County Institutes or local organizations providing a suitable hall, lighting and heating the same, and bearing necessary advertising expense. The directors may employ an agent or agents to perform such work in organizing or conducting such Institutes as they may deem best. A course of instruction at such Institute shall be so arranged as to present to those in attendance the results of the most recent investigations in theoretical and practical agriculture.

Section 2. For the purpose mentioned in this Act, the Directors may use the sum as they deem proper, not exceeding the sum of Four Thousand Dollars (\$4,000.00) per annum, and that until otherwise provided by law the State Treasurer shall pay,

MONTANA FARMERS' INSTITUTES.

out of any money in the State Treasury not otherwise appropriated, a sum not to exceed Four Thousand Dollars (\$4,000.00) during each fiscal year hereafter, on the order of the said Board of Directors. Each Institute held under the authority of this Act, shall be entitled to a sum not exceeding Fifty (\$50.00) Dollars from the amount appropriated under this Act.

Section 3. That Section 5 of this Act be and the same is hereby amended so as to read as follows:

Section 5. That immediately upon the passage and approval of this Act, the Board of Administration shall meet in the City of Helena and arrange for the first series of Institutes throughout the State, and thereafter such Board shall meet annually on the second Tuesday in September to arrange for such Institutes, and they shall again meet on the second Tuesday in March of each year to audit all expenditures and arrange for the printing in pamphlet form, within sixty days of said meeting, of the "Institute Annual," and that the cost of said Annual shall not exceed One Thousand Five Hundred Dollars (\$1,500.00) in any one year.

Section 4. That all Acts and parts of Acts in conflict with the provisions of this Act be and the same are hereby repealed.

Section 5. This Act shall take effect from and after its approval.

B. F. WHITE,

Speaker of the House of Representatives.

JAMES P. MURRAY,

President Pro Tem, President of the Senate.

Approved March 6th, 1903.

JOS. K. TOOLE, Governor.

Filed March 6th, 1903 at 5:45 P. M.

GEO. M. HAYS, Sec. of State.

SECRETARY'S REPORT.

The past year has shown a decided increase in the interest in the work of the Farmers' Institutes. The people are recognizing exactly what this work means, and the workers are fitting their addresses to the needs of the people in the various districts. No person could have attended those meetings and noted the attention and interest in practical agricultural topics aroused by the discussions but would recognize them as an important factor in the agricultural development of the state. In all parts of the state there is a call for more meetings in the counties. Many more towns are asking that the institute deputation visit them. In such a large state as Montana it will not be possible to accede to all these demands without increased funds or some help on transportation expense. The correction of this difficulty when it arises is, however, in the hands of the people. We will certainly do all we can with the funds at our disposal.

During the past year the work has been more fully organized than ever before, and in the fall a bulletin announcing the meetings for the coming institute season was published. It proved to be a very satisfactory method of advertising the work. In addition to this, posters were sent to all the postoffices in the districts visited; a postal card was sent to every name on the Experiment Station mailing list and to every other person from the farming district whose address we had. We also encouraged the publication of a program for each meeting; this program to be made up from the list of topics submitted for each speaker and from such papers as could be arranged for in the locality. In many cases such programs were prepared and they added very much to the interest of the meetings.

The following list gives the Institute districts of the state and the speakers who visited each district last year:

District No. 1.

1. Cascade County.
2. Teton County.
3. Flathead County.
4. Chouteau County.
5. Valley County.

Institute Workers.

In Flathead County—W. B. Harlan, D. E. Bandmann, F. B. Linfield.
Other parts of District—W. W. Wylie, John W. Pace, R. W. Fisher.

District No. 2.

- | | | |
|-----------------------|---|--|
| 1. Missoula County. | } | R. A. Cooley, Agricultural College. |
| 2. Ravalli County. | | W. J. Elliott, Agricultural College. |
| 3. Granite County. | | Miss L. Harkins, Agricultural College. |
| 4. Powell County. | | Mrs. F. E. Marshall, Agricultural College. |
| 5. Deer Lodge County. | | |

District No. 3.

- | | | |
|----------------------------|---|--------------------------------------|
| 1. Lewis and Clark County. | } | John M. Robinson, Bozeman. |
| 2. Jefferson County. | | V. K. Chesnut, Agricultural College. |
| 3. Silver Bow County. | | R. W. Fisher, Agricultural College. |
| 4. Beaverhead County. | | |
| 5. Madison County. | | |

District No. 4.

- | | | |
|-----------------------|---|---------------------------------------|
| 1. Gallatin County. | } | V. K. Chesnut, Agricultural College. |
| 2. Meagher County. | | I. D. O'Donnell, Billings. |
| 3. Fergus County. | | F. B. Linfield, Agricultural College. |
| 4. Broadwater County. | | |

District No. 5.

- | | | |
|------------------------|---|---------------------------------------|
| 1. Park County. | } | |
| 2. Sweetgrass County. | | |
| 3. Yellowstone County. | | M. J. Elrod, University. |
| 4. Rosebud County. | | T. T. Black, Whitehall. |
| 5. Carbon County. | | F. B. Linfield, Agricultural College. |
| 6. Custer County. | | |
| 7. Dawson County. | | |

Detailed Report of the Institute Meetings for last Year (1904)
giving Town, Date of Meeting, and Attendance.

DISTRICT NO. 1.

County	Town	Date	Attendance at each session				Total
			1st	2nd	3rd	4th	
Flathead	Kalispell	Jan. 24-25....	60	125	50	100	335
	Columbia Falls	Jan. 27	50	125	.....	.....	175
Cascade	Great Falls	Jan. 19-22....	.....	.....	.....	.....	.....
	Cascade	Feb. 9	40	40	.....	.....	80
	Belt	Feb. 12	250	150	.....	.....	400
Teton	Chouteau	Feb. 10-11....	100	75	.....	.....	175
Chouteau	Chinook	Feb. 15	20	50	.....	.....	70
	Harlem	Feb. 16	40	75	.....	.....	115
Valley	Malta	Feb. 17	30	75	.....	.....	105
	Hinsdale	Feb. 18	25	.....	.....	.....	25
	Culbertson	Feb. 19	32	20	38	.....	90
Total for district .....		.....	.....	.....	.....	.....	1,570

DISTRICT NO. 2.

Missoula	Frenchtown	June 17	60	.....	.....	.....	60
	Missoula	June 18	45	80	.....	.....	125
Ravalli	Como	June 21	65	70	.....	.....	135
	Hamilton	June 22	20	.....	.....	.....	20
	Stevensville	June 23	30	.....	.....	.....	30
Granite	New Chicago	June 25	65	.....	.....	.....	65
Powell	Deer Lodge	June 27	16	25	.....	.....	41
	Helmville	June 29	25	100	.....	.....	125
Total for district .....		.....	.....	.....	.....	.....	601

DISTRICT NO. 3.

Lewis and Clark ...	Helena	Mar. 14	22	6	.....	.....	28
Beaverhead	Dillon	Mar. 16-17....	70	65	65	125	325
Madison	Twin Bridges	Mar. 18	70	100	.....	.....	170
Jefferson	Whitehall	Mar. 19	50	75	.....	.....	125
Broadwater	Crow Creek, S. H. ..	April 8	25	30	.....	.....	55
	Townsend	April 9	35	.....	.....	.....	35
Total for district .....		.....	.....	.....	.....	.....	738

DISTRICT NO. 4.

Meagher	W. S. Springs	June	13	...	30	...	...	...	30
Fergus	Lewistown	June	15	...	35	100	...	...	135
	Utica	June	17	...	25	75	...	...	100
Gallatin	Belgrade	June	8	...	50	...	...	...	50
	Bozeman	June	9	...	40	75	100	35	250
Total for district									565

DISTRICT NO. 5.

Park	Livingston	Nov.	21	...	40	50	...	...	90
Sweetgrass	Big Timber	Nov.	22	...	20	40	...	...	60
Yellowstone	Columbus	Nov.	23	...	45	75	...	...	120
	Park City	Nov.	24	...	35	75	...	...	110
Carbon	Joliet	Nov.	28	...	60	50	...	...	110
	Bridger	Nov.	30	...	75	60	...	...	135
Rosebud	Forsythe	Dec.	2	...	75	...	...	...	75
Custer	Miles City	Dec.	3	...	30	...	...	...	30
Dawson	Glendive	Dec.	5	...	75	...	...	...	75
Total for district									865
Grand Total ...									4,439

It will be readily seen by comparing the reported attendance in the 2d annual with that given in this table for last season that the attendance has increased many fold. There is yet, however, room for very much improvement. Meetings were held in many sparsely settled districts and it was encouraging to find farmers who had traveled 25 to 40 miles to be present at those meetings. It will also be noted that meetings were held in 39 towns during the year and 72 sessions were held. There were four two-day meetings of four sessions each, 23 one-day meetings of two sessions each, and 10 one-day meetings of one session each. The estimated attendance at these meetings was 4,439 people, which shows a very large increase over the attendance for the year before.

Much of the increased attendance at the meetings has been due to the earnest work of the local representatives of the Board and the local papers. The local representatives of the Board or the officers of local Farmers' Organizations have devoted a great deal of time and attention to the local arrangements and advertising, and I most heartily commend their zeal in this matter as without this support it would have been impossible to have attained the success reported. We would like to ask for them the hearty

support and co-operation of all the people where the meetings are held.

From what we have had an opportunity to observe in other places where the work has continued longer, I feel confident in asserting that when rightly handled and supported there is no educational work done by the state that is going to give larger returns than this Farmers' Institute work.

The farmer has been essentially a pioneer. He has not and does not enjoy the opportunities for education either from the public schools or from social or business associations that are available to those in the centers of population. The Farmers' Institute will help to fill this gap and may be made the center of an influence that will aid in attaining to yet better things in farm life.

We would ask for yet larger support for those institute meetings. First, those who are interested and recognize the value of this work should attend and urge their neighbors to attend. Second, those whose experience is wide, who are well informed, should attend that they may give of their experience to help their neighbors to better results. In so doing he is helping the financial condition of the community and is thus helping himself. A prosperous community will have better schools and teachers, better churches and preachers, better roads, and a better social atmosphere. Third, those who have met with difficulties in their farm work may at those meetings find a solution that may turn losses into profit and prosperity.

Again the program should not be confined to the deputation sent out by the Board. Local men and women should take part. These local experiences are often of as much or more worth than the broader experiences brought by the worker from a distance. We hope to see more local help on the programs as time goes on.

I believe that the merchants and business men of the towns and cities should also be very largely interested in this institute work. In all our farming valleys the people directly or indirectly live from the farm. The success or failure of the crops, the prosperity or otherwise of the farming community means more than all other factors combined in the prosperity of the people in such towns. The farmer is the great foundation producer in those farming valleys, his grain, his livestock, his fruit,

and his other farm products are the raw materials from which the urban population work out their living and their prosperity. There is thus a close economic relation between the country and town people, and everything that will help the economic condition of the farming communities, as the Farmers' Institutes will, will also prove a benefit to the towns in those farming valleys. I believe, therefore, that it will be decidedly to the advantage of the merchants and business men to aid by every means possible the Institute meetings.

From the standpoint of the Board, we shall certainly endeavor to do all we can to advance this work and to increase its value to the people, and we would be pleased to receive at any time such suggestions as may be offered towards making the work more valuable to the people.

Financial Statement for Year Ending Nov. 31, 1904.

Expenses of Administrative Board	\$87.10
Travelling Expenses of Institute Workers	1,818.86
Illustrative Material	595.70
Office Expense	410.30
Postage and Stationery	68.25
Advertising	109.35
Freight, Express and Drayage	23.70
Third Annual Report 5,000 copies. 500 bound in cloth.	837.21
Total	<u>\$3,950.47</u>

The Financial Statement for the year shows how the funds appropriated by the Legislature were used. Compared with the year before considerable has been used for illustrative material, charts, lantern slides and lantern equipment. This illustrative material has added very much to the interest in the work. We are firm believers in advertising and we desired to make it possible for every farmer in the state to know of these meetings. We spent nearly three times the amount in advertising as was spent the year before but the increased attendance we feel fully justified the increased cost. The traveling expenses of the workers is also greater but this is accounted for by the greater number of meetings held.

Acknowledgments.

In conclusion I would like to place on record our very great appreciation of the help given by several of our successful farmers, especially, Mr. I. D. O'Donnell, Mr. W. W. Wylie, Mr. John M. Robinson, Mr. D. E. Bandmann, Mr. John W. Pace,

Mr. T. T. Black, and others. Our educational institutions have also given willing and able support. The Agricultural College and Experiment Station teachers and workers and Prof. M. J. Elrod of the State University.

Our thanks are also due to the local representatives of the Board, to the local agricultural societies, and to the newspapers for their generous and hearty support in looking after the local advertising and arrangements.

Our acknowledgments are also due to the railroads for transportation for the Secretary and for the free carriage of the bulletins over the State.

Preface.

In looking over the material on hand for this report it was found that there were several papers and many interesting discussions on alfalfa and clover by some of our most prominent growers and feeders. Because of the very great interest in this topic, it was thought well to supplement this matter to a certain extent and to give these topics a permanent place in the report. In view of this fact also our frontispiece will introduce our readers to a few of our prominent growers of alfalfa and clover. It must not be forgotten, of course, that in many cases these men are talking of the experiences on their own farms, and as each farm and each district has its individualities, the facts given have to be studied in this light. While these facts and experiences will be of very great help they cannot take the place of the individual study of his farm and soil by each farmer.

We hope this book, the volumes already issued and those to come may become an epitome of the agricultural practice of the state, not to be looked over and then thrown aside, but books to be studied and kept for reference. To make the books more valuable for this purpose a table of contents and a comprehensive index have been prepared for each volume. The practical and scientific facts which these volumes will bring together will in time make this series a very valuable collection and worth careful preservation by the farmers of the state.

Very truly,

F. B. LINFIELD,

Secretary.

March 1st, 1905.

Fodder Crops.

ALFALFA AND ITS POSSIBILITIES.

By I. D. O'Donnell, Billings.

Alfalfa is as old as the hills. It has been cultivated since civilization among the Persians. It was known in Greece 450 B. C., and was familiar to the Egyptians. The Romans esteemed it highly as forage for the horses of their army.

Its cultivation has been maintained in Italy to the present time. From Italy it was introduced into Spain and by them carried to Mexico during the Spanish invasion.

The Spaniards also took it to South America where it now grows wild in places.

From Chili it reached California in 1854. It rapidly spread eastward and is now largely grown throughout the humid as well as the arid states.

The Mormons took it up in the early days and one of the maxims left by the great colonizer, Brigham Young, was to "plow deep and sow alfalfa."

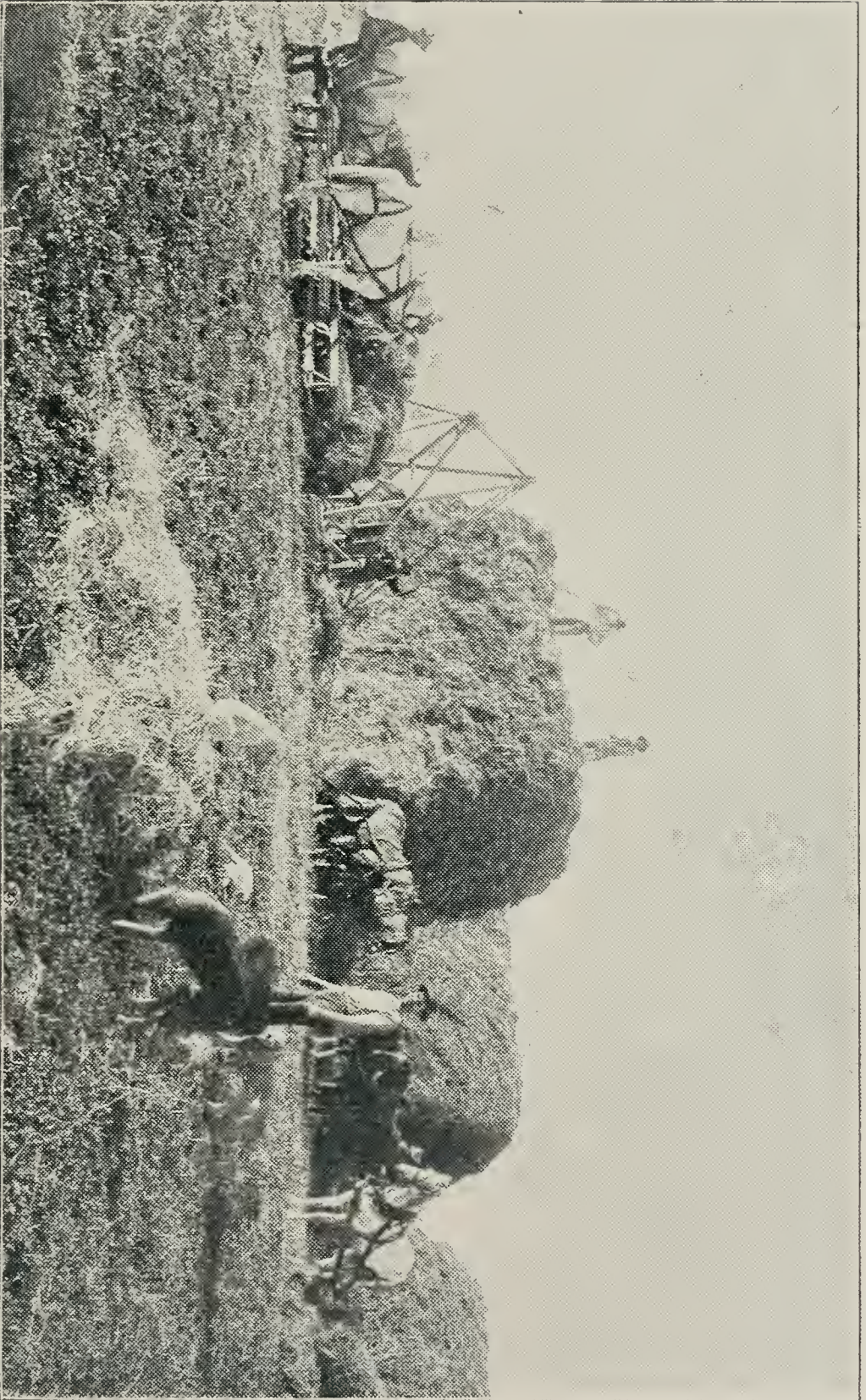
In its first introduction in Montana it was known as "Chillian Clover." The seed came to us before the dawn of the railway era under that name and went under that name for number of years.

The secret of its great success would seem to be in its root penetrating powers. Plants four or five months old are known to have roots five or six feet long, and if there is any moisture the root will penetrate the hardest hardpan.

It is common to find roots from 1 to 15 feet long and F. D. Coburn, in his book on alfalfa, mentions a place in Colorado where an alfalfa root was found at a depth of 129 feet.

In Montana it will grow on most any kind of soil, sandy loam being the best however. It will do well on gumbo, on the highest bench land or the lowest river bottom. It will come nearer making a crop on gravelly land than any other plant.

It is about the last crop to be killed by alkali. It will, after



STACKING ALFALFA.

once well set, come nearer making a good crop without water than any other one I know of.

On the other hand it will stand more water and oftener in the hot season if properly put on and off than any other plant.

If a farmer does not care for hay it is a paying crop to let it go to seed. There is a great demand for the seed. You can cut as much alfalfa as from any other hay, and still raise a crop of seed that is as valuable as the average crop.

It will produce from three to seven tons to the acre.

It will produce from five to fifteen bushels of seed to the acre.

It is the nearest to a balanced ration of any crop grown.

It has more protein than wheat bran.

It will come nearer crowding out all foul weeds and grasses than any other plant. Three hundred and sixty stalks have been grown from one seed. Unlike most any other plant it does not exhaust the soil but enriches it; so much so that grain yields nearly double where alfalfa is plowed up.

In the Greely settlement in Colorado they are now plowing up alfalfa for winter wheat and sugar beets and they report yields fully double that on soils where alfalfa had not been sown.

The digestibility of alfalfa is changed less by the process of curing than of any other forage plant. Dry alfalfa in the summer is as palatable to the dairy cow as green grass, it contains largely the succulent qualities of green grass in June, keeping the digestive organs open and active and it has a cooling effect on the blood.

Fed to dairy cows alfalfa maintains the flow of milk equal to June grass for nearly a whole year. It can be chopped as fine as wheat bran and mixed with corn meal to form a balanced ration.

Such a mixture is worth more pound for pound than the original cornmeal.

Where alfalfa grows to perfection and is a common product, such a land is certain to flow with milk and honey.

It is superior to white clover, sweet clover or buckwheat, and under favorable conditions will give honey from June to October.

It is, therefore, the best forage crop that can be grown by the bee keeper and the production of honey is becoming an important item in farm economy in the valleys of the Bitter Root and Yellowstone, and the industry will spread to other valleys.

Feeders in buying sheep to go on grain are willing to pay as

much for alfalfa fed sheep in the Yellowstone as they are for range sheep in St. Paul or Omaha.

They more than make up the difference in price in the grain after being fed alfalfa.

Alfalfa will grow one and two crops on any land that will grow winter wheat.

It can be ground into meal to feed hogs and chickens.

Alfalfa in money value is worth 25 per cent more than clover and 60 per cent more than timothy.

One acre will pasture thirty hogs for six months. Ten milch cows can be fed on less than two acres by soiling. Three pounds per day makes a full feed for fattening lambs. Four to five pounds makes full feed for fattening aged sheep.

Thirty-five pounds make full feed for fattening steers. A lamb will winter and thrive on two pounds per day. Sheep fed on alfalfa will gain from eight to fifteen pounds in seventy-five days and double that with small grain ration added.

Steers will put on a pound to a pound and a half per day on straight alfalfa and if fed grain rations will put on double that amount.

Lambs wintered on alfalfa will produce one to two pounds of wool more than when on the range.

Brood sows will do well all summer on alfalfa pasture alone.

Horses have been known to put on six pounds a day where grain ration was fed with it.

Alfalfa is a great poultry feed when cut fine and mixed with cornmeal. This is also a good way to feed it to hogs in winter.

To give an idea what an acre of alfalfa will do I quote figures made some time ago:

One acre irrigated alfalfa will produce 10,000 pounds; one acre of range in enclosed pasture will produce 500 pounds; one acre open range will average a production of 50 pounds; or again, one acre of irrigated alfalfa will feed one steer 400 days; one acre of enclosed range pasture will feed one steer 20 days; one acre of average open range will feed one steer ten days.

Putting it in the form of sheep it will show as follows: 100 acres irrigated alfalfa will run 1,600 sheep one year; 160 acres enclosed range pasture will run eighty sheep one year; 160 acres of open range will run forty sheep one year.

Apply these figures to the stock growing in arid regions, taking the proportions given above in round numbers and 160 acres for

irrigated alfalfa will carry 146 steers for a year and it would require something over eight sections—5,120 acres—of dry range to carry the same number of cattle, or putting it briefly, one acre of irrigated alfalfa is worth as much as thirty-two acres of average dry range.

A windmill which will irrigate one acre of alfalfa will add the equivalent of thirty-two acres of range to the farm or ranch. An engine and pump that will irrigate ten acres of alfalfa will add half a section to the farm. That is, it will increase the productivity as much as will the acquisition of the additional land.

A pumping plant large enough to irrigate twenty acres will add the equivalent of a whole section of range.

And any irrigation system which will irrigate a whole quarter section of alfalfa is as good as the permanent acquisition of eight sections of range. In other words a section of alfalfa is the equivalent of 20,000 acres of range as a source of food supply for stock.

These figures are worth studying. They show that a great many of our livestock men are worrying about more range and scheming and planning to get more land when they would find it easier and more profitable to irrigate some of the land they already have and get better returns from it.

The money lost last winter in eastern Montana and Dakota in winter losses on sheep and cattle if spent in reclaiming land and seeding it to alfalfa would have raised enough feed to have fed every hoof of stock in the district six months, and the land so improved would be a source of revenue afterwards with good prospect that it would double in value.

If water here can be brought on the land at from \$25 to \$50 per acre one full crop would pay for the entire cost of construction.

The feeding of cattle and sheep on alfalfa means the keeping of at least \$1 to \$2 per head on sheep and \$10 to \$20 per head on cattle at home instead of sending it to the eastern states.

The growing and feeding of alfalfa means much to the banker and merchant. In speaking to a prominent banker in our city he said the loans for stock feeding were the best the bank carried and that he had never had a single loss from them.

It means a pay day in winter when other money was shortest. Under the old conditions pay day came only at beef and mutton shipping time.

It has been the turning point in several of the western states. A noted writer said, "It has been the salvation of Kansas."

In speaking to some prominent people from Utah they said it was the turning point from hard times to prosperity in Utah. It grows well in the Canadian Northwest.

Although grain and other crops are raised profitably by our farmers and the yield is large, yet they never did so well as since they began to raise alfalfa and feed it to sheep and cattle on the ranch. Every year the area sown to alfalfa has been increased and still every year the demand for alfalfa has more than kept pace with the increased yield.

It almost appears as though the industry was still in its infancy and that as the range area decreases the business of feeding will become more general and that there will be no limit in its expansion.

To the beginner I would say that it is important that you put your field in the best of condition, as when alfalfa is once seeded it is there for a lifetime, our oldest fields being now 22 years old. In preparing our fields after plowing we grade off all back furrows and fill in all dead furrows.

Fall plowing is best as the seed does best in firm ground. If farming without irrigation in a very dry section summer fallow would be best. We find old worn out stubble fields the very best places for alfalfa.

In case there are small ravines it will pay to make laterals from them to lead the waste water out again on higher ground.

In sharp corners and in head lands near your main ditches I would leave out the alfalfa and sow brome or blue joint, as you can't very well mow in these places and some grass that will make good fall pasture will be better than alfalfa.

It will pay to make your lateral ditches before seeding, and save a great deal of labor in the future in cleaning your ditches, but if your field is on a hillside or land that is likely to wash then seed first and make your ditches afterwards.

We prefer seeding with the drill, 20-pounds to the acre, as in the case of a dry season you are more sure of a good stand. We prefer early seeding, and without nurse crop, as in that way we get a fair hay crop the first year which is worth as much as an ordinary grain crop.

If you use the nurse crop it will be better to sow your nurse crop light so as not to smother the alfalfa.

Sow as early as you can have your seed bed well fitted; there is very little danger of frost from early seeding. Seed grown in the north is much hardier than seed from warmer climate and is less liable to winter kill.

Mow the first time when about eight or ten inches high, that is the new crop. This will cause it to stool out, and it will grow a good second crop, and sometimes a third crop the first year.

We find it better to irrigate after the first and second cuttings and not to irrigate after the third cutting, as it has a tendency to winter kill if too wet in the fall.

If irrigated before cutting it will delay the curing of the hay considerably; on the other hand if irrigated before cutting it will start the next crop more quickly and increase the total hay crop.

Again, irrigation will depend a great deal on the seasons and the farmer's fields. Some land may require as high as three or four irrigations, while other land will raise two or three crops with only one irrigation.

If you are doing dry land farming it will pay to give it a good discing every spring. This will to some extent take the place of irrigation.

If the first crop is left to full bloom the leaves will fall off and the stems get woody before it can be cured. If your stock is all sheep or mostly lambs, or dairy cows, it will pay to cut a few days earlier than if your stock is cattle or horses.

We let it lie in the swath 24 hours, according to the weather, then rake it into windrows and bunch as soon as possible. Hand bunching is much the best, but a great many bunch with a horse rake. Leave it in the bunch until well cured as it will not stand the stacking if damp. It will not hurt the hay much if the bunches do bleach on top.

If the ground is damp or it should rain on the bunches we turn them over with the horse rake an hour or so ahead of the stacker.

We use the buck rake and stacker, but others handle it equally as cheaply with low wagons, and derrick forks for unloading. We stack in the fields and make the stacks about 18 by 24 feet, holding about 15 tons to the stack. This makes a good stack to haul from in the winter as teams can get to all sides, reducing the cost of unloading fully one-half. We have considerable wind and find that this style of stack enables us to take advantage of it.

Three men with buck rake and stacker will put up two of these stacks in one day, and five men three of them. By stacking in the field there is less danger of fire than from stacks near feeding yards, while in summer it will cost from 25 to 50 cents extra per ton to haul. It costs us about one dollar per ton to cut and stack, and in favorable seasons somewhat less.

You should handle the entire crop for the year including the irrigating and feeding for \$2.00 per ton.

Feeding Alfalfa.

It pays to build good feed yards and confine the stock while feeding to fatten; but in case you are roughing the stock over winter, then just feeding in meadows and pastures will do. It is important that there be plenty of water in feed yards as stock drink a great deal of water while feeding on alfalfa. We have also kept salt before them at all times.

We find racks more economical than feeding on the ground, but some winters when the snow is just about right and the weather is just what is wanted the ground feeding is just as good.

As a test case I divided a band of sheep one season and fed one part in the racks with one feed a day; the other part on the ground with two feeds a day, and found that the stock feeding from the racks used four pounds a day, while the stock fed on the ground used four and a quarter pounds a day. The rack fed sheep gained two pounds more on a sixty day feed than the ground fed sheep. We found one feed a day to be the best when it can be arranged, but in feeding large numbers two feeds a day will save labor. With one feed a day there is less waste, and the sheep are more contented.

We never drive among the sheep with a wagon. Feed regularly and do not disturb between feeds, as every time they make a rush over the yards they waste feed. We have cheap straw covered sheds on the north side of our yards but when sheep are in good fix they seldom go into them.

Lambs will thrive and go through the winter on two pounds and put on some gain. Two and three year old wethers will consume from four to five pounds per day, and should gain five to ten pounds in sixty to seventy days' feed. Never feed frosted alfalfa to sheep as it is almost sure death.

In feeding grain the best profits are from a light feed. An average of one-half pound wheat for ninety days gave the best returns on lambs.

Steers with all the alfalfa they can eat will put on good finish with five to seven pounds of grain per day.

Alfalfa will do well on most any kind of soil. In our valley we have some of the heaviest kind of gumbo, while there are good fields where the gravel is very near the surface. In a considerable portion of our valley the water is only from four to six feet from the surface, and the alfalfa grows well on such land. I think there is less danger from the roots reaching the water than from the water on the surface. Where it is winter killed it has almost always been from too much water on the surface.

In raising seed we have settled on the first crop as the best. It is important that it be not irrigated, as irrigating will start a second growth and it will not seed well.

The older fields are best for seed. If sowing on purpose to raise seed only sow eight to ten pounds of seed per acre.

The same would apply to seeding for dry land farming. Some cut seed crop with the binder. The old fashioned harvester or dropper is good to cut it as it leaves the crop in nice bunches to handle. It is best to thresh from the field.

Discussion.

Chairman W. B. Harlan: If there is anyone in the audience specially interested in this, and thinks Mr. O'Donnell has not told us all he knows, we would like to have him bring it out.

Mr. O. H. Barnhill: I would like to ask Mr. O'Donnell if he thinks it practicable to grow alfalfa in the Flathead Valley. We grow it to some extent in Iowa, and the great trouble is to get it cured on account of the damp weather. It has been experimented with in Flathead county, but I don't know to what extent.

Mr. I. D. O'Donnell: The great secret of curing alfalfa in a damp country is to leave it alone. As I told the woolgrowers last year, the hobby of the Montana people is, if it rains or showers, to turn it over or tedder it as they would other hay; and we find, no matter how long it rains, if we bunch it, and leave it, it will come out all right. Never touch it until an hour before you get ready to go out to stack.

Q. How large are the bunches?

Mr. I. D. O'Donnell: Just as large as would be convenient for one forkful. In a crop of two tons to the acre they will be

quite thick on the ground. Last year we had a very wet season, and for the first crop we had continuous wet weather. Some farmers bunched it up and then thinned it out, and it practically went into the stack worthless. Lots of people never touched it at all, although it looked brown, looked like poor manure going into the wagons, but those that left it alone put it in the stack finally when it was thoroughly dry, and it was excellent hay. There is this about it, when it is put in the stack green, and the sap comes out of the stalk, there is more danger of heating than being wet from rain. If you stack it with sap in, there is danger of heating, but moisture in alfalfa from rain will not heat like the sap in the stalk. That heated hay has been coming out with all the leaves on it. Although a little brown it is coming out good hay. But the secret, in a damp country, is to leave it in the bunch, not to attempt to tedder it or work it like timothy.

Mr. C. F. Stork: I would like to ask if there is any preferred time in plowing up alfalfa fields? I have always understood it is hard to kill.

Mr. I. D. O'Donnell: It is hard to kill. Two plowings in the fall and plowing again in the spring will kill it. If you are going to seed back to alfalfa, it doesn't cut much figure. We sometimes plow alfalfa and grow a crop of grain, and it will seed back again. The alfalfa will not affect your grain crop at all.

Mr. H. C. B. Colville: I would like to ask Mr. O'Donnell if he has ever examined the roots of his finest alfalfa to see if there are any of those nodules that are supposed to be so good for the vigor of the plant?

Mr. I. D. O'Donnell: I never have, but I should judge, from all I have read of it, there must be something to it, because we do raise those heavy crops. But I have never examined the roots. We have dug up roots twelve and fifteen feet long, and they were very long and smooth. I don't know whether those nodules are large enough to be seen with the naked eye, but I understand they are. I have had one or two samples twelve and fifteen feet long, but they have been as smooth as if they had been shaved by a jackknife.

Mr. H. C. B. Colville: I rather disagree with Mr. O'Donnell upon the importance of this scientific inoculation. I was wondering whether his roots had the nodules, but I hear they

have not. Now, seven or eight years ago I examined my alfalfa very carefully. I had some alfalfa fifteen years old, and had great difficulty in finding any with any nodules. I took them to Professor Elrod at the University, and he examined them with the microscope, and he found none at all; but by digging around in the patch I found some that had nodules, and by spraying them over those I knew had not I gradually improved the vigor of the plants that had no nodules. The finest plants were the ones I found with the nodules, and they were always the largest and finest plants. I think inoculating the soil increases them very considerably, and I believe it would pay to do it on a large scale.

Mr. W. M. Wooldridge: Mr. President, I would like to bring out a little discussion on the winter-killing of alfalfa. Largely from Brother O'Donnell's kindly interest, around Chinook a great deal of alfalfa has been planted, and last year, unfortunately, a great deal of it was winter-killed. In looking the matter over, we are not altogether satisfied as to what was the cause of that winter-killing. It has been the practice during the past few years to permit the water in the ditches to run very late in the fall, and it has been thought that that was really the cause of alfalfa patches killing out so largely last winter. But to show the value of alfalfa, even although it may winter-kill occasionally, one of our best farmers this year told me that if his alfalfa winter-killed every other year he would feel that he was justified in planting alfalfa, that he might follow that alfalfa with a grain crop. He said, as an instance this year, that his average oat crop yielded only fifty bushels per acre, but on a tract where alfalfa killed last winter the yield was 103 bushels; just double the yield. And several have reported the extraordinary yield following a killed-out alfalfa crop. The question of winter-killing is a very serious one here. It will be understood, in our section, we do not farm without irrigation, and it is possible we irrigate too late.

Mr. I. D. O'Donnell: In regards to winter-killing: in the early days in our valley, on the farm that I own at the present time, which was, perhaps, the first field of alfalfa sown in our valley, the second spring the foreman found some patches winter-killed, and he announced at once that alfalfa would be a failure in our valley, from the fact that it was winter-killing. It did kill in spots, and we never did find the reason. But since

those one or two years, the winter-killing is such a small proposition, no one pays any attention to it. There were reports of winter-killing last winter, but not a great many. Nearly every spring in our valley a man buys a new farm that has got an old alfalfa field; he believes it has killed out; he says his neighbor's failed, and thinks his has not started. The fact is the old meadows are slow; the new meadows, sowed last spring, will be up three or four inches before the old meadows start. The percentage in our county of winter-killing is hardly worth mentioning. I think the reason for the winter-killing you speak of is the late irrigation; it will not stand going into the winter wet and icy. The drier it can go into the winter, the better it comes out next spring. It will stand lots of snow. We have had two winters with practically no snow in our valley, and before that we have had winters with considerable snow. But one or two farmers have attempted to gain an irrigation by irrigating in the fall, and they have found that it hurts the alfalfa. There are peculiar things about it. Some years if you drive over it with a wagon the next year you will see that track all summer; every crown hit apparently is killed; there are other years when you drive over and never see a stalk killed.

Mr. C. F. Stork: There is no question I am so interested in as this growing of alfalfa. It is an experiment with most of us. There are few alfalfa patches in this county. I have been one of the biggest grain raisers, I believe, in the state, and it is a very poor way of making money. Any system that pauperizes our soil is not the proper system of farming. I discovered where the buffalo wallows were, where nothing else hardly will grow, I got my best stand of alfalfa. I would like to inquire as to the killing out of alfalfa, if pieces that have rooted for several years are as apt to kill out as those which have not got good substantial roots?

Mr. I. D. O'Donnell: On the lower Musselshell, where there are buffalo wallows, the farmers all seeded alfalfa and timothy. In the low spots they have the timothy and in the high spots the alfalfa, from the fact the water stood in the low places. Water forty-eight hours on alfalfa, if standing, will kill it out. As to whether old alfalfa or new alfalfa is the more apt to winter-kill, I cannot tell. Of course, the older alfalfa gets bunchy and if there is a weak stem in the old field it will be crowded out and

quit, You can't reseed in old stubble. If you throw on new seed, it will grow, but next year it will disappear. The old bunches will grow up and crowd them out. But take your bunches and thin them out by disking. It has been found we can disk alfalfa after each cutting and increase the cutting by a good disking both ways; cut the crown down each way two or three inches. In Kansas, I believe, they make a special feature of disking. We have disked a great many fields in Yellowstone county with good results.

Q. At what season do you disk?

Mr. I. D. O'Donnell: In the springtime, and sometimes we disk after each cutting. There are a great many things coming up that are new to us in the way of taking care of the meadows, in the way of splitting up the crown instead of putting on new seed.

Mr. W. M. Wooldridge: Have you noticed any ill effect from pasturing alfalfa, especially new fields?

Mr. I. D. O'Donnell: Not in our valley. They do advocate, though, not pasturing the first one or two seasons, but for following years we have pastured ours. We have pastured sheep from spring to fall. Our alfalfa fields in the spring are nearly like a road; there is not a stubble left, not a leaf, and we find our yields just as good as they were ten years ago.

Q. Did you ever find any damage to stock or cattle?

Mr. I. D. O'Donnell: No, sir. We take precautions in bringing in range sheep, but we don't with horses and cattle. We keep our dairy cows and calves on it all summer; never take them off for the season. Last fall I do not believe there was a loss in our valley. Some falls, I think, when we have warm weather late in the summer, there is a danger at that time, just during the last hot days of the season, especially if the fall crop has grown up and got to be quite high; but after two or three good hard frosts it is perfectly safe. We drive right onto ours with bands of sheep, and for years we have had no losses whatever.

Q. Do you find where water stands on it in the winter it will kill it.

Mr. I. D. O'Donnell: Yes, it is sure to kill where there is water on it in the winter. We find where there is a great snow-drift, at the edge of the drift it will kill. It won't kill under the drift, but just at the edge.

Q. How long after you sow your alfalfa do you get your hay crop?

Mr. I. D. O'Donnell: Why, in our valley, if sown real early in the spring, we may get a heavy crop in the fall. If sown after April, we get a good crop in September. But we get our best crop the next year.

Q. They say it takes three or four years to get a full crop of alfalfa.

Mr. I. D. O'Donnell: Well, those are reports from other states. With us it is the second year.

Q. Do you ever sow it with other crops?

Mr. I. D. O'Donnell: No, usually alone. But where we have been sowing it is always on stubble ground, where there is a nurse crop anyway. The secret with starting alfalfa is to clip it down. In fact, that is the medicine for alfalfa; any time it doesn't look good, clip it, and it will come up better; if looking yellow or peaked, cut it. If you left it that way for another three months, it would stand right still. If you don't cut it, it will practically do nothing that year.

Q. Do you seed it in the stubble without any covering?

A. No, we always cover it; put it in with a drill.

Q. How much seed do you put in?

Mr. I. D. O'Donnell: Twenty pounds to the acre; that is a good full seeding.

Q. Why do you favor putting it on stubble?

Mr. I. D. O'Donnell: I sow on stubble ground. We have always used our old ground. When ground has got played out with grain and is practically useless for anything else, we seed it with alfalfa.

Q. You plow it first and harrow it?

Mr. I. D. O'Donnell: Yes, or disk it; anything to get a nice seed bed; it needs a firm seed bed. Fall plowing is better than spring plowing. In spring plowing you should roll it; it wants a good foundation beneath. Seeding it on spring plowing, if only partially worked, you will have a failure.

Q. Do you use a disk on fall plowing?

Mr. I. D. O'Donnell: Yes, sir.

Mr. O. H. Barnhill: Mr. President, I don't know whether we care to take much more time about this, but one thing I would like to call attention to. Some people rather enjoy disagreeing with others, but for my part I don't, but it seems to

me one of Mr. O'Donnell's statements ought to be corrected. I don't doubt but that he understands the curing of hay, and has had good success, but he is certainly mistaken in saying that the main essential, the one thing we ought to pay especial attention to, is to get the sap out of the stalk or out of the plant, that is, the natural juices of the plant, if that is left in the hay will spoil, but a little outside moisture will not hurt it. I think the facts in the case are just the opposite. The juices of the plant that are naturally in there have no power of spoiling the plant, that is, a small quantity. Clover hay is often cut down and put in the barn the same day, and is quite green, and has a great deal of this natural moisture in the plant when put in the mow, and still it will cure up and make fine hay; but if it gets quite dry and gets outside moisture like dew or rain, it molds and spoils. That is because the rain or dew in coming through the air gets inoculated, you might say, with microbes and spores of fungus disease and spores of mold; and if these get on the hay and are not dried off thoroughly, the hay is apt to mold and spoil, even if there is the least bit of it.

Mr. I. D. O'Donnell: I think the gentleman misunderstood me a little, but what I tried to make plain was the cutting of the alfalfa. Alfalfa of course has about eighty per cent water; the very best you can cure it, you still leave fifteen to twenty per cent water in it; when hay is perfectly dry, brittle, so that apparently there is not a drop of water in it, there is still fifteen to twenty per cent water in it. Now, if we put up alfalfa when only half cured and put that in the stack, it will heat; it will heat so the stack will set fire. In Kansas that is one thing they don't want, spontaneous combustion in the hay. Large stacks have set fire to themselves. Take a load of green alfalfa before it cures at all, it will get so hot in six or eight hours, you can't put your hand in it; it gets so very hot you can't handle it at all. Although in some sections of the old country, they make for cows what they call "black feed", and let it go through the sweating process and let it go black, and they make black hay for dairy cows. This it seems does not injure the hay for dairy cows. Now, with us, if we put up hay only partially cured, with no rain at all on it, it is sure to heat, there is no saving it, especially the first crop. But if that hay should get cured once, and get rain on it then, it could go in with any amount of moisture, it will go through winter and come out all

right. It may be we are mixed up as to the amount of rain. A shower we don't mind at all; we go right on haying in the shower, but we have to be very careful about putting hay in before it is thoroughly ripe. We feel if it is wilted and the water in the hay is worked out, it is all right, but if we leave that in there and put it in the stack, it will spoil; but after once well cured, apparently from what we have in our valley we can put double the amount of ordinary rain on it, and it will still keep.

Mr. W. W. Wylie: This is a subject on which we cannot differ like fruit raising, so there is no chance for discussion; but I think it is important that I should corroborate what Mr. O'Donnell has said about alfalfa hay. The last few years my directions have been to rake and cock the hay the same day it is cut, with very little wilting; I don't care whether there is any wilting; and the curing is done in these small cocks not to exceed eighty pounds, and it does not matter whether it rains every day. And I say alfalfa is the best grass to turn rain there is. It will cure in those cocks, and you will know when it is cured because it is nicely dry. I suppose it passes through a kind of heat, but it does not hurt it when it is in these small cocks; it is very important to put it in small bunches. So we try to have cocked in the evening what we have cut in the forenoon; then when cured in that way the stems are soft, the leaves are all on, and it does not matter about it raining when you stack it.

Another point is the question of clean seed. I bought a ranch this fall thirty miles away from where I have been raising most of my alfalfa. And I find the dodder vine is in the alfalfa, and I propose to plow it up and re-seed it to alfalfa. The objection to this vine is not so much that it is not good feed itself when cut and cured with alfalfa, but the objection is you cannot cut the alfalfa satisfactorily with the dodder vine in it; that is, it holds down what is cut and passes right over the end of the divider. It requires several men to go along and pull the swath away to allow the machine to run along clear next time around. This is a bad state of affairs.

Q. How long have you had that dodder?

Mr. W. W. Wylie: I bought the ranch this year, and it was in the seed; the seed was bought at Norris, a ranch in Madison county. While I have a very nice lot of alfalfa with that dodder in it, it is a field I will have plowed up and reseeded.

Q. How long has that been seeded with the alfalfa?

Mr. W. W. Wylie: I should judge about three years, and I don't think there is any way to get rid of it. You understand the dodder vine is a parasite, lives on the plant entirely. It will come up in the ground, and, as soon as the alfalfa plant comes up, it leaves the ground and attaches itself to the plant. It is after the morning glory style. And the directions are to cut it down and burn your alfalfa as it lies on the ground and it will kill the dodder without killing the alfalfa. But I would rather take chances by plowing it up. All seed should be examined with a glass before purchased, and nearly all honest dealers in the selling of seed have a glass with which you can examine the seed. The alfalfa seed is the shape of a kidney, and the dodder seed is more like a turnip seed. On three or four ranches where I raise alfalfa I have no trouble, and can corroborate everything Mr. O'Donnell says with regard to the raising of it.

There is one thing I have been asked: Is it profitable to grow other grasses with alfalfa. I have one field that was seeded with timothy and alfalfa. I got an excellent crop the first time, that horses like better than anything else, of timothy and alfalfa; but I can't get anything else, because the alfalfa is kept down by the crop of timothy, so that I have to pasture out that field. I don't get three crops there; I do where I raise alfalfa straight. So I will say, on dry land it is not profitable to sow anything else with alfalfa, because it is too valuable a crop. A timothy crop you only get with the first crop, and the next crop that you get is alfalfa straight, so whatever room is taken up with that extra grass is that much lost after the first crop.

Chairman W. B. Harlan: On the dodder question, I have a field of alfalfa, a forty-acre field, that has been seeded for twenty-three or twenty-four years. The seed when I sowed it was very foul, and when it came up there was dodder all over the field. I was scared and disheartened. The first year I found it everywhere; the next year there was considerably less, and it has since entirely disappeared. The last two or three years I haven't found as much as I could put in my hat. I have found, during the twenty-three or four years I have observed it, that dodder will not trouble where you give the alfalfa plenty of water. It was only on the dry ground and in the second or third crop that I did not irrigate, that I found any of it after the first two or three years, and there is now none in the Bitter Root valley that I know of, although the seed that was sown

was very foul. I do not believe it is going to be a nuisance; at least it is not one with us.

Mr. R. N. Sutherlin: I have some testimony to offer in regard to that dodder plant. I have specimens in my office from where there was a great deal more dodder than alfalfa, and they came from the Yellowstone. Now, I took occasion to write to the experiment station and a half dozen others in the alfalfa-growing region, and they do not consider dodder a menace to alfalfa to any extent whatever. The government officials recommend simply cutting and letting it lie and turning it over. They say that doesn't injure the alfalfa, but it was just as well to rake it and burn it on the outside of the field, that it had just the same effect. They stated, however, just the opposite of what our worthy chairman thinks, namely, that it was excessive moisture that produced the dodder, or made the dodder flourish.

The great problem with alfalfa growing in Montana is winter-killing; there is no question about that. And in regard to the saving of the first crop, that would be easily solved with a silo, if necessary, because the silo will pay for itself anyhow in the additional percentage of the value of the feed. And the time will come, possibly, if our June rains continue, that it may be necessary in some valleys for the farmers to put up their first cutting of alfalfa in silos. But above the line of 4,800 feet alfalfa is an unsafe crop, supposed to be, although it is grown as high as 7,000 feet, in the vicinity of Bear Lake, with very good success. On Smith River we are just a mile above the sea, and when we get a crop of alfalfa we figure on simply three tons; that is, from two cuttings. We don't pretend to produce the great crops at that altitude that you can grow in the Yellowstone valley, which is a natural home of the plant. The plant is as much at home in the soil of the Yellowstone or the lower Musselshell as it is in Arizona, where they cut seven crops. But we have never been able yet to solve the problem as to what causes the winter-killing. Water is supposed to be the prime cause, but the conditions vary so that the men themselves who have failed can't tell. A few years ago in our valley one field of three hundred acres was wiped off the face of the earth, and there was scarcely a plant of alfalfa left, while other small fields in the immediate vicinity were not affected a particle. And we have alfalfa growing in the valleys that is fifteen years old, and

the plants are more vigorous the older they get, and produce more hay, and there is no question but the alfalfa plant will be, is today, the greatest forage plant known to civilized man, and the point we started out to discuss, the question of dodder, is very simply and easily gotten rid of and need only affect one crop.

Q. Which one of the crops of alfalfa, when you don't have irrigation, is the best crop for seed?

Mr. I. D. O'Donnell: The second crop is supposed to be the best, but here in Montana it is not always best to try to get the second crop. Last year had they tried to get the second crop, it would have been a failure.

Q. Is there lots of seed for sale?

A. There is considerable, but there is a great demand for it. It would be pretty hard for an outsider to get any in the Yellowstone valley this season. It is nearly all spoken for, although there is a lot on our markets; our merchants have a lot of choice seed that came up from Big Horn. There will be more grown next year.

Q. Will alfalfa kill out wild oats?

Mr. I. D. O'Donnell: Oh, yes, every time; they will disappear the first season with alfalfa. That is what started us sowing alfalfa, to get rid of wild oats. They got so bad we couldn't raise grain in our valley.

Q. Do you irrigate your seed crop of alfalfa?

Mr. I. D. O'Donnell: Well, if saving a second crop, we irrigate the stubble; of course we cut the first crop off and irrigate the stubble. But if you leave the first crop for alfalfa seed it is best not to irrigate. With either crop, if you irrigate it at all, you are taking some chances of starting more growth and getting very little seed. To get seed, let it grow up and bloom; it has to dry; if you irrigate it, it starts a second growth and the seed crop is a failure.

Q. I would like to ask Mr. Wylie if he thinks there is any advantage in stacking alfalfa with straw or stacking straw with the alfalfa?

Mr. W. W. Wylie: That is not practiced very much, because we have so many cattle to use up the straw. But to any man who has straw left I would suggest, as a very profitable thing, to have straw stacked with the alfalfa. For instance when the men are stacking alfalfa, have two men hauling straw and pitch-

ing it in the stack at the same time. There are two reasons for this; the first is, the oats or wheat straw furnishes a balance for the ration, and the stock will like the straw just as well if stacked with alfalfa. The other advantage is it makes the alfalfa easier to cure.

Professor F. B. Linfield: We find that by adding ten to fifteen per cent of straw, sometimes twenty per cent of straw, and feeding it in the winter time, the combination of alfalfa and straw in fattening the steers gives just as satisfactory results as the feeding of alfalfa alone. It is a question of economy under those circumstances. Another reason that appealed to me in regard to the matter is that alfalfa has a high percentage of flesh-forming or protein matter, and a small percentage of carbo-hydrates or heat-producing matter; straw is very much the other way; the two combined will balance the ration in a measure. Handling in the way Mr. Wylie has stated would probably be an advantage in making the straw more palatable.

Another point, in regard to that dodder question. I refer to the Utah station; I was there nine years; my experience here as yet is limited. We sowed dodder seed on alfalfa to find out what the effect would be. It was a piece of old standing alfalfa. The first year the dodder was just as thick as a mat, as thick as it could grow all around the alfalfa; the next year it was less, the following year still less, and in about four years it disappeared, without any particular treatment at all. Now, I can't tell you why. I just state the facts. There was no particular reason as far as I know, but it seemed to find there an uncongenial place and disappeared. It was in the northern part of the state. In some other parts of the state I have seen dodder kill out square rods of the alfalfa, so that the stand was dry and dead and practically useless. Of course, these experiences we cannot always reason from, because they are a little too limited.

Another point that has not been referred to, but which I think a great many people over parts of this state are interested in, is the question of growing alfalfa on dry land. I think many people in Cascade county and probably in Flathead are interested in this question. This gentleman (Mr. Stork) referred to the fact that he had been growing grain, and it does well here, and the thought has come to me, as I have been thinking about it, that the grain-growing is going to exhaust the land, the grain is selling out his farm by the bushel and putting

nothing back. This alfalfa plant feeds the land. I believe if Mr. O'Donnell will dig up (not pull up, but dig up) an alfalfa plant, dig it up carefully and wash the roots, and will then examine that alfalfa plant, he will find upon that plant nodules. Last fall, in lecturing to my class of students on the question of these nodules in building up the land with nitrogen, I told the boys to go out in the field the next morning and dig up for me, in the way I have stated, some clover plants. I said "Did you find any nodules?" They said "No." I said "Get me the plants and see if we cannot find some, and we went and examined those roots, and we found those nodules thick, clustered all over those plants. In that nodule there is a microscopic organism, which you could see under a high power microscope. That microscopic plant has the power of feeding upon the free nitrogen of the air. The air, you know, is composed of two gases—oxygen and nitrogen; nitrogen enters into all these flesh-forming compounds, like lean meat or muscle or curd in milk. This minute plant has to feed, and it feeds upon this free nitrogen of the air, and under those circumstances it also stores that nitrogen in the soil. It is for this reason, after you have plowed up that alfalfa plant that your grain crop is going to do better with you and is going to grow better. Some soils have not got that germ in them, and the plant and soil can be inoculated under those circumstances with advantage. Now then, is it possible to grow alfalfa upon this dry ground, where we are carrying on our grain operations, to put into that soil the needed nitrogenous ingredient, to put into the soil the needed humus which is going to enable us to grow for years good grain crops upon that land? I refer to these points because they are points for us to consider. We know the benefits derived from nitrogenous leguminous crops in respect to the soil. Now, is it possible to grow them upon our dry lands in order to get that benefit? I believe it is, but I believe there are a great many points to be investigated and looked into on this question. I speak of this, because Mr. O'Donnell has not referred to that phase of the question, and because I know you are particularly interested in it, but I won't take up any more time tonight.

THE STARTING, CARE AND CURING OF ALFALFA.

By B. F. Shuart.*

Under proper conditions and skillful management alfalfa is a crop of magnificent possibilities. But the difference in the practical value of the results between perfection and mediocrity in growing this wonderful plant is so great that no one who contemplates undertaking its culture should rest content with a low ideal of achievement. Let the beginner resolve at the outset that he will rest satisfied only with the highest attainable success, and that he will spare no pains which may prove necessary to its realization. The following suggestions with reference to the management of alfalfa are not offered with any pretense to infallibility, but simply as outlining the methods by which the writer was enabled, after having experienced his full share of failures, to reduce the successful cultivation of alfalfa to a basis of certainty.

Selecting and Preparing the Ground.

In starting alfalfa the first point claiming consideration is the selection and preparation of the soil. Bench land is preferable to bottom land, and sandy loam is more desirable than clay, though some clay soils answer well for alfalfa, but the plants are longer in becoming established. Alfalfa should not be sown on sod for the reason that so valuable and permanent a crop should never be laid on a surface rough and difficult of irrigation.

The plowing should, if possible, be done in the fall. In the spring, before seeding, the land should be carefully graded to a surface so even as to obviate the necessity for the irrigator ever to step into the growing crop to force the water with the shovel. Whoever neglects to do this will, when too late, have abundant and unceasing cause to repent his folly. The labor and cost of grading land at the outset are infinitesimal compared with the aggregate labor and loss incurred in irrigating rough, uneven land twice or thrice each season for an indefinite term of years. After grading, and immediately before sowing the seed, the land

*Note.—Mr. B. F. Shuart a minister of the early days owned the farm at present owned by Mr. I. D. O'Donnell. He planted the first alfalfa in the Yellowstone Valley, and this article from the *Irrigation Age*, and loaned by Mr. O'Donnell was, he believes, the first article on Alfalfa written by a Yellowstone farmer.

should be flooded. Irrigation at this stage serves a threefold purpose. First, it reveals the high spots, if any remain, and these should at once be worked down and irrigated. As soon thereafter as the ground will bear working, the seed should be sown.

Secondly, irrigation before seeding insures the prompt and complete germination of the seed. This is a point of vital importance, for without a dense and uniform stand of plants it is not possible to make a high quality of alfalfa hay. If the stand is thin on the ground the stalks will be coarse, woody and indigestible, and in curing the leaves will dry and fall off before the stems are sufficiently cured. But if the stand is thick the stems will be fine and the foliage will be so abundant that the curing process can be effected evenly and without perceptible loss of leaves.

One who has not had experience in feeding alfalfa, especially to sheep, cannot realize the immense superiority for feeding purposes of a high quality of alfalfa hay, such as I have described, over a coarse, stemmy quality. The one is peaches, while the other is but the stones, and the substitution of the one for the other will produce a marked change in the general appearance of a band of sheep within forty-eight hours.

Results When Irrigated.

In starting alfalfa, I am aware that the almost universal practice is to trust to the fickle and scanty showers for moisture, or in the absence of these, to sheer luck. Doubtless now and then a fairly satisfactory stand is secured in this way. I followed this system myself during the earlier years of my experience as an alfalfa grower, in Montana, with the result that fully one-half my efforts resulted in flat failures, while I never, in a single instance, attained to a degree of success comparable with that which I realized uniformly after I began to irrigate before seeding. Judging from an observation of alfalfa fields in several of the arid states, I am forced to believe that the great majority of alfalfa growers are practically ignorant of what constitutes a strictly first-class stand of alfalfa. And this because the system of seeding in vogue is one which depends for its success upon a combination of favoring conditions which rarely happens. The danger is, when rain is depended upon, that the sun and wind will dry out the soil to the depth of the seed before it can take sufficient root to survive. I have had whole fields perish in this way

after the seed was well sprouted. But irrigation immediately before seeding, completely obviates this danger by supplying the soil with a fund of moisture compared with which a copious shower is a bagatelle, and which causes the seed to spring with a rapidity and completeness scarcely attainable otherwise.

A third advantage secured by irrigation before seeding is that it supplies the earth with a reservoir of moisture sufficient to sustain the plants in unchecked and vigorous growth until they are strong enough to bear irrigation without injury. The critical time with alfalfa is the first six weeks of its growth. Flooding during this period is quite certain to give the plants a backset from which they seldom fully recover before the second or sometimes not until the third year. And it is not often that, in the arid States, the rain falls with sufficient frequency to dispense with the necessity for irrigating the plants during this period. By soaking the earth before seeding, however, the plants will make vigorous growth until they are ten to twelve inches high, after which they may be irrigated with safety. Under this system I never failed to take two crops the first season, aggregating, perhaps a ton and a half to the acre in two cuttings, provided the seeding was done not later than the 20th of May. From the first crop of the second season onward the yield was full fledged.

Time and Manner of Sowing.

Alfalfa should not be sown until the danger of hard frost is past. I have seen very young alfalfa survive frost, and I have seen it completely destroyed by it. It is not prudent to take the risk.

A point scarcely second in importance to that of irrigation before seeding is that of burying the seed to a sufficient and uniform depth. For this purpose I know of nothing equal to the press drills. The seed should be put into the grain box and be run down the spouts. But with the drill great care must be taken not to bury the seed too deep, for too deep seeding is quite as fatal to success as too shallow. A depth of two inches is about right. Whatever implement may be used for covering the seed it should be followed by the plank drag to smooth and compact the surface. When the drill is used, twenty pounds of seed should be sown per acre; but if broadcasted, thirty pounds should be used. Great care should be exercised in the selection of seed to see that the grains are plump and healthy and that it

is scrupulously clean. If it contains many shrunken seeds reject it, for if they spring at all they will produce only puny, worthless plants.

After alfalfa has become established, a single copious irrigation after each cutting will ordinarily be found sufficient. Irrigation before cutting is undesirable, because it leave the earth so soft as to interfere with the movement of loads.

Making Alfalfa Hay.

The conversion of a heavy mass of green alfalfa into a choice quality of hay is an operation calling for no small degree of skill and experience. But the process is one to be learned by intelligent observation. The first and second crops of each season need to be cured with special care or they will certainly mold in the stack. Beginners need to be beware on this point. The knack to be acquired is that of curing the hay sufficiently to insure its keeping sweet in the stack, without becoming so dry as to shed its leaves in the handling. This cannot possibly be accomplished by curing fully in the swath. A method much practiced is to rake the alfalfa while still green into windrows, where it is allowed to cure somewhat more, and finally to make it into moderate sized cocks in which it is allowed to stand until ready for the stack. This process makes a very nice hay, but where a large acreage is to be taken care of it is too slow and expensive. Alfalfa may be cured with entire success in the windrow, but it is important, when cured in this way, that there be ample facilities for putting it into stack very rapidly when ready, otherwise it will become too dry, and much of it will be lost in the handling, especially if it has to be carried from the field on wagons. Alfalfa should be cut on the first appearance of bloom.

Stacking Machinery.

After trying a variety of appliances for stacking alfalfa, I found the so-called table rakes (which are simply an improved form of the old "go-devil"), and the ricker which supplements them, the best suited to my conditions. By means of these rakes the hay was taken from the windrow by horse power, and was conveyed to the stack in masses weighing from 200 to 400-lbs.; was there delivered to the ricker, and was by the ricker landed into the middle of the stack. The only hand power required was for the distribution of the hay after it was placed upon the stack. Five men and five horses with two rakes and the ricker easily

put thirty tons of hay per day into stack, at a cost, as wages were, of about thirty-five cents per ton.

The great drawback to these rakes is that they can be used to advantage only on short hauls. The plan on which I had laid out my farm happened to be one, however, perfectly adapted to their use. The special feature referred to was a system of parallel roads running through the farm about thirty rods apart. These roads were protected from the irrigation water by ditches on either side, and the fields consisted of the long and comparatively narrow belt lying between the roads. The alfalfa was cut in blocks of about ten acres, and was stacked in the road immediately adjacent. The stacks were thus distributed on the roads all over the farm, but as the hay was used for feeding stock this arrangement was not objectionable, while it reduced the cost of moving the hay during the most busy season to the minimum.

I have received many requests from men who are bringing new lands under alfalfa for helpful suggestions as to how to proceed. Were I to attempt to condense my advice into a brief paragraph, I should say: First subdue your land by one or more grain crops; then carefully lay off your farm by a system of fields and of roads having special reference to convenience and economy in handling the crop. Next grade our fields so perfectly that, in irrigating, when you shall turn the water from the ditch, gravity will do the rest. Then irrigate your land and sow your seed. And, finally, let there be one man on the place who shall make it his business to master the details of irrigating, curing and stacking alfalfa, and who shall exercise personal oversight of these processes; and let this man, if possible, be the proprietor himself.

ALFALFA IN BEAVERHEAD COUNTY..

By J. E. Morse, Dillon, Montana.

The first we knew of alfalfa in the United States was its introduction into California from old Mexico in the early fifties. It has since been introduced into nearly every state in the Union. It was introduced into Beaverhead county nearly twenty years ago, and its increase has been constant from that time to the present. To-day it is considered one of the most important crops we have in Beaverhead valley and the acreage is constantly increasing.

I shall tell you, in a general way, of my observations as to the

most successful planting, growing and curing of this forage plant, hoping to be able to furnish, to the new beginner, some ideas for his guidance, and hoping to get some criticism from the veteran raisers that will help my own success.

Preparation of Ground.

In preparing the ground, I would recommend fall plowing, thoroughly irrigated before plowing. The ground should be plowed very deep and thoroughly; it should be thoroughly pulverized and leveled so as to give the young seed the best possible chance. I consider the most successful way to put in alfalfa is to sow it with grain; irrigating it at the regular time the grain should be irrigated. In this way the ground will be thoroughly seeded for next year's crop. By sowing a nurse crop of grain with it, you can handle and irrigate it much more easily than in sowing by itself, as the heavy roots of the grain will keep the land from washing, and a good crop can be got from the grain, which will more than pay all expenses. Sow from fifteen to twenty-five pounds per acre, according to condition of soil. As a nurse crop, I would recommend barley first, wheat second and oats third, sowing about three-fourths the amount of seed per acre that you would sow if you were not putting it in in conjunction with the alfalfa. If you are putting in your alfalfa on summer fallow or fall plowing, be sure it is thoroughly pulverized and leveled in the spring before seeding, as nothing is better than to give the young plant plenty of well pulverized, moist soil so that its growth will be certain and rapid. If you broadcast with a drill, I would recommend a thorough harrowing after the drill. Let your harrow run in the direction, as nearly as possible, that water will naturally run, as the harrow marks help very much in running the water over the ground easily.

The Kind of Land.

Alfalfa will do well on nearly any kind of land where the altitude is not higher than fifty-eight hundred feet; but, in a general way, would recommend land with good drainage, and the sloping benches will be found to be the best natural soil for this plant. I would try to put in land that has been farmed at least one year prior to the year of seeding. To parties owning land outside of Beaverhead valley and above Ryan's Canyon, I would not advise going into alfalfa extensively without thoroughly paving the way by tests of small acreage, as there seems to be some-

thing in the general conditions of soil and climate of the high valleys that is not conducive to the raising of this plant; but from Ryan's Canyon north, you are perfectly safe to put in any amount of land that is thoroughly prepared and for which your pocket book will allow you to buy seed.

Re-Seeding and Cultivating.

After your land has been seeded to alfalfa about three years, it should be cultivated by using a disk, followed by a harrow; first re-seeding any places where the plants have killed-out or become thin. You will find this cultivating will greatly increase the crop, besides making the quality of hay much superior.

Irrigation.

If your acreage is large in proportion to your water supply, I would start irrigating as soon as the frost will allow your ditches to run in the spring and irrigate as often as your land may require it, remembering, always, to never allow water to stand on a given piece of ground over twenty-four hours at a time, and give it plenty of time to thoroughly drain, warm up and grow before another application is made. On most ground, two irrigations before the first crop will be found sufficient, and one after the first crop is taken off, making three irrigations for the entire season. Experience has taught me that it is good to irrigate early in the season, as, by giving your land early irrigation, you are able to crowd your first crop forward and have it ready to cut as early as July 1st to 4th; and, by so doing, the second will more easily mature before the frost will reach it in the fall.

Harvesting Alfalfa.

The harvesting of alfalfa should begin as early as it fairly commences to bloom. By so doing you will get a better quality of hay; your second crop will be very much better, and you will not have the woody, dead stems generally seen in our alfalfa crops. I recommend raking at the earliest possible moment that the hay will do. As soon as it is half wilted, it should be put in the windrow. As soon as it is cured a few hours in the windrow, it should be shocked, either by hand or hay rake. If you are able to get plenty of help, I would recommend hand shocking; but with the scarcity of help which has prevailed in recent years, I have found it very successful to shock with a horse rake. Be sure that you have plenty of rakes as, with the change of weather we are apt to have at that season of the year, with the combination

of winds and hot sun, hay often cures more in four hours than it will under other conditions, in three days. So I say, have hay rakes enough so you can put your entire mowing crew to raking when a condition of this kind comes up. Otherwise, you will lose very much of the value of your hay by getting it so dry that the leaves will drop off. Begin stacking as soon as it will possibly do to go into stack without heating. In most cases, we are too timid about stacking hay green and I will venture the assertion that there are ten tons put into the stack too dry to every one that goes in too green. Even if it molds and turns black a little in the stack, it does not hurt its feeding qualities. I have found it practical at all times to have a few sacks of salt with my stacking crew, and, whenever a few loads of green hay come upon the stack, scatter a few buckets of salt through it, and this hay is most relished by stock when feeding.

The Best Way to Stack.

The prevailing custom for stacking alfalfa in this section of the country has been the using of one net and an ordinary sized hay rack, using what is known as the mast derrick with a swinging arm for lifting your load on to the stack. This manner of stacking is very successful and probably cannot be improved on very materially, as the stacks are put up in fine shape and the hay keeps uniformly well. Last year I introduced what is known as sweep rakes or bull rakes for stacking, and feel certain that hay can be put in the stack for from twenty-five to thirty cents less per ton than by pitching on to a hay rack and unloading with net and derrick. You can certainly get along with fewer teams and less trouble in keeping men by the sweep rake process than any other manner of stacking. It is easier on men; equally as easy on horses, and, while the stacks are not quite as imposing, they keep the hay equally as well. I would recommend putting each butt or setting of hay by itself, leaving fourteen to sixteen feet between stacks at the ends, so that you can drive on any side of the stack; thus getting the benefit of the wind when hauling your hay in winter time.

Amount of Hay Procured Per Acre.

The amount of hay procured per acre will vary from one and one-half to six tons per acre and I believe it is safe to say that three tons per acre is an average crop for Beaverhead county.

Quality of Hay.

Alfalfa has excellent feeding value. Tests at the different government experiment stations have proven beyond a question that, ton for ton, there is no better hay for general profit to the farmer than alfalfa. It is good for your work horses and driving horses; good for beef cattle, dairy cattle and young cattle; good for stock sheep, mutton sheep, young lambs, hogs, poultry, or, in fact, anything you can give it to. It is relished by all stock better than any other forage plant known, and farm animals will leave any other kind of hay if they can get alfalfa. It will put on more pounds in weight, ton for ton, than any other hay grown, and therefore, has a greater feeding value, acre for acre, than any forage plant than can be found.

Fertilizing Qualities.

One of the greatest uses of the alfalfa plant is its general fertilizing qualities. Its roots penetrate very deep into the soil and when it is plowed up and grain crops put on the ground, it will be found that, in many cases, that very larger yields of grain are obtained. In order to get the best results on our farms, we should have a regular rotation of crops, in which alfalfa should be the principal factor in the rotation. That is to say, we should have a piece of ground, say three years in alfalfa and two years in grain or vegetables. By so doing, we will double the crops of our land. After a piece of land has been put in alfalfa for several years, if it broken up and put in grain or other crops for two seasons and then reseeded to alfalfa, you will find that your crop from the second seeding of alfalfa will be much increased from what it was the first. The reason for this is that the penetrating and decaying roots of the second seeding will get the benefit of the deep and decaying roots of the first seeding. It is a safe prediction to say that every acre of land in Beaverhead valley, when thoroughly seeded to alfalfa has been increased in value from ten to twenty dollars per acre.

In conclusion, I would say that alfalfa is the very corner stone of prosperity in the farming industry in the lower valleys of Beaverhead county and, if I should be called upon to formulate three rules for the success of the Beaverhead county farmer, they would be about as follows:

First—Sow Alfalfa;

Second—Sow more Alfalfa;

Third—Sow still more Alfalfa.

Discussion.

Mr. Robinson: I would suggest that in plowing you do not plow too deep; the most successful farmers have adopted plowing two or three inches deep. They have had great success in this way with land that they thought was worthless.

Mr. Robinson: I would like to ask if in planting so much seed a great deal didn't smother out?

Mr. Morse: Yes, some smothered out, but on the whole I consider it the best way to sow.

Mr. Nelson: I have always found, if the ground was in good condition, that fifteen pounds of seed was as good as thirty-five pounds, if anything a little better. When it comes to twenty or thirty pounds to the acre it makes it a little too thick. It never gets as high as it should be and won't produce as much hay to the acre and I don't consider that the hay is any better for feeding purposes than the hay that grows up high. Now I had some experience last year. I seeded some ground twenty pounds to the acre and some less than fifteen pounds and I couldn't see any difference. If the ground is in a good condition, twenty pounds is as good as thirty or twenty-five to the acre.

Now speaking of spring irrigating, I have always irrigated my alfalfa as early as possible in the spring, about the first of May, but as Mr. Morse stated he irrigated his alfalfa about the first of April; now about the first to the middle of May I found is as good or a little better than the early irrigating. I should like to know if the land Mr. Morse irrigates so early wasn't dry in the fall; in that case it would be better to irrigate early. It is a settled fact that when you irrigate so early in the spring the land will not produce as much hay later on as if it was irrigated later. In all cases, we will have to irrigate as soon as possible. Mr. Morse, was your alfalfa dry in the fall?

Mr. Morse: Nearly all of my alfalfa is dry in the fall, I don't give it as much water in the fall as it should have and it is very dry.

Mr. Robinson: I would like to ask if any of you have had experience in raising alfalfa seed. It seems to me that we ought to raise some here.

Mr. Featherly: I believe Mr. James Murray had some experience in raising seed.

Mr. Nelson: Last season there was considerable alfalfa left here for seed, but the season was cold and it didn't seem to do

well, but I think it would be possible to raise alfalfa seed here in ordinary seasons. The seed looks plumper and stronger than what is shipped in here. Now what the yield of alfalfa seed would be I never heard.

Mr. Robinson: Do you know what process is used to raise that seed?

Mr. Nelson: They didn't irrigate as much as for hay. One irrigation about May would be sufficient for alfalfa seed. I have noticed that if we plant alfalfa on high land the seed seems to mature and be more plentiful than where it is irrigated. Now where alfalfa has got a thick growth it doesn't seem to fill out as well. I think very little irrigating would do better than irrigating in the usual way. I have noticed where alfalfa grows by ditches and don't get any water at all it bears good seed.

Mr. Robinson: I was just going to say that over in the Yellowstone they have been quite successful in raising alfalfa seed and they don't irrigate it at all. A considerable amount of money goes out of the state every year for seed, which could be used here if we could raise the seed.

ALFALFA IN THE GALLATIN VALLEY.

By W. W. Wylie, Bozeman, Montana.

Since the greater number of the farmers of this valley seem to be running to clover, of late, it seems but fitting that alfalfa should have some defense—defense, not apology.

If the object be to use our land so as to renew or enrich it for grain farming, and at the same time avoid summer-fallowing, or the loss of any return from the land every other year, then clover is the thing.

But if the object be to get the most from a given amount of land, in the way of a hay product, both in quality and quantity, then alfalfa is the thing.

I will not say much of clover as it has abundant advocates in this presence, and I am one of them for the purpose hinted at above. I will only here refer to it by way of comparison as a feed and as to yield.

Alfalfa is a perennial plant; needs no replanting, after once having obtained a good stand. Clover is usually a biennial plant and lasts well but two years. Alfalfa is much more easily cured and saved without mould and dust than clover is. Alfalfa

yields much more to the acre, on well adapted land; three crops per season in this valley.

I believe alfalfa has a much better feeding value per ton than that of red clover.

About the only objection made to alfalfa is that it is not good feed for horses. This is an imaginary objection. My farm work, for years, has been done on alfalfa feeding. I grant that horses sweat more easily or more profusely when fed upon this hay, but that is no hindrance to their endurance. The best men I employ, sweat most. An alfalfa fed horse never needs nitre; never any trouble with his kidneys. The only objection to feeding it to livery or driving horses, is that it keeps the stable moist, since this hay causes a horse to drink more than timothy or wild hay does. Work and driving horses should be fed only the first crop. I feed horses first crop; cattle second crop, calves or young stock third crop. Stock hogs will winter nicely, without other feed, if let run about alfalfa stacks. Third crop alfalfa furnishes all the green food needed for laying hens.

Alfalfa will not do well on all land where clover does well.

Alfalfa farming should never be attempted on low ground, or ground where the roots may reach permanent moisture at a depth of from four to eight feet. As soon as the rootlets touch permanent or continuous moisture it becomes pale sickly looking and soon dies out. It may do well on such ground for about three years. Then it will die. Never sow it on land that for any part of the summer becomes sub-irrigated. A stony soil with good drainage, such as the lands in the vicinity of Belgrade, I believe to be well adapted. But the best and surest land for alfalfa growing, is our bench lands with clay sub-soil, where irrigation is necessary.

On such land I get the first crop without irrigation, but as soon as this crop is stacked, I flood the ground. After the second crop is stacked I flood the ground again; two irrigations for three crops. No part of the field should be covered with water for a longer period than 36 hours.

Never let water on the field or any part of it after the last crop is taken off. My experience has shown that about the only danger to the continued life of the plant is to have the ground thoroughly wet when it freezes up in the fall.

This leads to the question as to whether it is hurt by pasturing in the fall. For some years I kept all stock off my alfalfa

land entirely. I considered it too valuable a product to take any chances as to having it killed out by pasturing the fall growth. However, I have learned that it does no hurt to pasture it in the winter when the ground is frozen. To those who have given much attention to the plant it will be no news to be told that all stock prefer the root to the plant, if they can get it. Hence if pastured close when the ground is unfrozen or soft, they will bite down so low as to injure the crown of the root and the plant dies. They can get this growth in the winter as well and it is as nutritious as when green. There is no danger from bloat in the latter case.

A word as to how to start an alfalfa field. It is much better to sow it alone. It should be sowed with a drill through the hose, but letting the hose run without pressure; twenty pounds of seed to the acre. This can be carefully gauged by spreading a canvas under your drill; setting your drill upon blocks so that you can turn the wheels freely, and by watching the indicator on the drill which tells the amount per acre, or number of acres, you can gauge the drill very accurately. I was obliged to use plaster of paris to close up many places that would let the seed through too fast.

The ground should be well prepared; free from clods; moist—if you must first irrigate it to make it so. Seeds should be covered two inches deep, at least. Sow about the first of June. The alfalfa plant is very tender the first summer but very hardy afterwards if grown under the proper soil conditions. The reason for not starting it with a nurse crop is, that when the nurse crop is harvested it is then deprived of its shade while the ground is dry, and being exposed to the bare rays of the harvest sun, the tall delicate plant with its head cut off, in most cases, and no immediate water supply, as it should now have, it in most cases dies.

Just a word or two as to how to harvest and save the crop. Cut the first crop just before the blossom appears. This gives you a softer stem and much finer hay in every way. If you waited a week longer you would get more hay, of course, but you lose nothing in cutting earlier, for that extra week's growth you get in the next crop. Since pursuing this plan my third crop has become as heavy as either of the others.

Let the horse rake follow the mower. Allow no curing or even wilting, before getting it in windrow. Have it put in small

cocks at once with hand fork. Cocks that weigh when cured from 80 to 100 pounds. Let it stand until cured. Let it do all the curing in these small bunches in the field. In this way rains are no hindrance to the work. You save all the leaves, and get a much finer hay in every way. No danger from mould or dust. Alfalfa sheds rain more perfectly than any other known hay.

Discussion.

Q. Will live stock prefer the root to the stalk of alfalfa if they can get it?

A. Yes, and there is no danger from bloat from eating the root. Sow your alfalfa with barley if you use a nurse crop. Sow 20 pounds of alfalfa seed to the acre. The ground must be well prepared, free from clods, and it should be covered two inches deep at least. The alfalfa plant is very tender the first summer and very hardy afterwards. Cut the first crop just before the blossoms appear, although by waiting a week you would get more hay. My directions to my men are to cut just as soon as the blossoms appear.

Q. How long does it require to cure in the shock?

A. You cannot always tell; it will dry in damp weather. It is very queer about that. And there is no danger from bloat, mould or dust. We top our clover stacks out with alfalfa.

As to wild oats: I do not believe this valley is worse troubled with wild oats than ours was a few years ago. I tried to kill them out with timothy, and had excellent timothy for seven years, and then two-thirds was wild oats. It is not so with the alfalfa and clover; they kill it out. If you start alfalfa with a nurse crop try it with barley rather than oats. The oat leaves give too much shade to the alfalfa. If you expect to start a good crop of alfalfa do not sow our barley too thick. Then cut the stubble down close so as to make the alfalfa sturdy. You do not cut very much off when you are cutting your nurse crop. If you can cut it down long enough before the fall to get it started again then it commences to stool out.

Mr. O'Donnell of Billings, and myself, had exactly the same experience. Once when in the east in the spring my foreman on the ranch where most of the alfalfa was, wanted to plow it up, and said it was killed. He wanted me to wire back if I wanted it plowed up. I didn't pay any attention to it and waited until I got back home, and then it had commenced to come up. That

was 6 or 7 years ago, and I am still cutting that field.

Now, as to killing the alfalfa off, if you want to plow it up again. It enriches the ground certainly more than clover, but it is too hard to start to raise it to just enrich the ground. The only way you can plow it under is to get a sharp cutter and plow. It pays to do that for if the point of the plow runs into many of these roots a four horse team would work to pull it out. If you use a very sharp plow and cut the roots you can kill it out. I have found that if you turn cattle and horses into that ground after it is plowed they will attend to the roots and you will never have any more alfalfa, and they do splendid on it. It is better than any root crop you can get. Do not be frightened when you start alfalfa in the spring if it looks as though it were dried up. It does not start nearly as early as clover, but it will come all right. Plow it very deep, harrow it and smooth it before you sow, and if the ground has a tendency to be light, I would advise you to roll it before you put the drill in. Cut the heads the first year, for that is what makes it live. I get three good crops every year.

Q. Would it injure it after the third crop to turn the hogs in?

A. No, provided you do not pasture it too closely with hogs, but when you see the leaves getting down pretty close take the hogs out. All hogs must have rings in their noses or they would bite the tops all off and dig up the roots.

Remarks. I have got a field 20 or 30 years old, and so far as enriching the ground is concerned I can illustrate just about how it did with me. I had a piece of land—a 40-acre field—very even all over, with very little variation in quality. Before I sowed alfalfa I put in timothy and sowed oats, and couldn't get a crop worth harvesting the first year. I sowed it in alfalfa and kept it in for sixteen years. Then I decided to make it into a garden: It had been in alfalfa 16 years and I had taken two or three crops of hay off of it each year and returned nothing to it. I plowed it up and the next year put it into garden and I do not believe there is a richer piece of garden soil anywhere. I had the finest piece of wheat I ever saw there for two or three years, when I tried to raise oats it was a failure.

Q. What variety of alfalfa seed do you buy?

A. Mr. Wylie: I do not know just the variety; it usually comes from Utah. We get our own seed from Gallatin. They get 12 cents a pound on the ranches there. I am going to try

this year and get some Yellowstone valley seed. The seed that comes from Utah is generally clean. They cannot begin to supply the demand. There is twice the demand in Gallatin valley that there is seed to sell, so we have to engage it ahead.

Q. How do clover and alfalfa grow on alkali ground?

A. They grow all right. We have not a great deal of alkali in the Gallatin valley.

Q. Why would you rather pasture after it is frozen?

A. I do so because of the danger of biting the roots. After you have got the alfalfa field two or three years old the stems protect the roots. They will eat it down so you would not know there was anything there, but it comes up all right in the spring. Then there is no danger of hurting the stock after it is frozen—no bloat—but there is danger in turning stock into a field of alfalfa in the fall. My alfalfa fields are all fenced separately and I never open them until after they are thoroughly frozen.

Q. In regard to the land where it has been grown for fifteen or sixteen years; what effect has it on the land in regard to continuing to produce alfalfa? Does it wear out for alfalfa, just as it does for other crops?

A. As I said yesterday; I tried to find out in Mexico where they raise so much alfalfa, and so far as I can judge there are fields there over 200 years old. They say there are fields in California and Arizona over 75 years old, and the alfalfa is just as good.

Q. Do they ever return anything to the land in Mexico where they grow this crop?

A. No, sir.

Q. Is it in an irrigating country?

A. Yes; all the places where I noticed alfalfa fields were on the plateaus of Mexico City and further south.

Q. Would you use any different method in starting alfalfa where irrigation is not practiced, as in this valley, compared with Gallatin, where irrigation is practiced?

A. Yes, that is why I said seeding without a nurse crop would be better here.

Remark. From my experience in Flathead valley I would never sow a nurse crop. We have a dry period from six weeks to two months, and the plant cannot live through until we get moist weather.

About pasturing it when the ground is frozen, I think it is dan-

gerous, because the ground with the roots will be tramped in and bruised and that kills off the plant: for that reason I would never advocate pasturing alfalfa when the ground is frozen, because it will bruise and has a tendency to destroy it.

Q. Another point I would like to bring up is, is alfalfa better feed than clover; and if so, why?

Remark. I don't weight stock and I can only give my experience: I frequently buy calves in the fall, and of course I get nearly all kinds, and I find that the calves do much better if fed with clover than when fed on alfalfa, and I raise five times as much clover as alfalfa.

Q. Will the Professor tell us the protein value of alfalfa and clover?

Prof. Linfield: The alfalfa contains the most protein. The great point in it's favor is it's palatability. I have been working with this alfalfa, not as long as Mr. Wylie, but have been making some observations for ten years, and what he has told you I can heartily agree with. I have fed alfalfa to cows, calves, steers and to fattening hogs, and I have seen it fed to chickens, and all that is said about alfalfa as being good for those classes of stock is correct. The only thing, that I find better to feed to hogs with a grain ration, is good skimmed milk. I am quite certain that alfalfa makes good feed, and so does the clover for that matter.

On this question of pasturing I want to say a few words: I have pastured alfalfa as a permanent pasture and I have also pastured it by turning the cows out on it in the fall. There is not very much danger in pasturing alfalfa if the cows are not turned on it hungry and if they are kept on it all the time. I find in pasturing alfalfa that it has a tendency to thin out. After pasturing a field for two or three years alfalfa seems to grow less.

In regard to that question of bloat: my experience has been that alfalfa was worse for bloat than clover. My plan has been to turn the cows into the pasture in the spring and watch them closely for a few days. I used to keep a man with the cows for a few days, and he would take them out at night, but after that the cows were in the pasture night and day. I lost one cow by turning the stock into the pasture while hungry and letting them feed at will. One of my yearling heifers bloated and died, but it was from the deviation from my rule of watching them at first, and gradually letting them have all they want. The best remedy

I have found for bloat is about a table-spoonful of turpentine in a quart of linseed oil. If you catch the cow twenty minutes before she falls down, you can save her. If the cow has gone past that, the best thing you can do is to stick her, using a trocar and canula.

In regard to seeding down on dry land, I must agree with my friend here,—as a rule sow it without a nurse crop. My reason is this: the great need of our soil, especially on non-irrigated land, is moisture,—moisture that will last all through the summer season. In some places in California, in the Sacramento Valley, I understand they get good crops where there is no more than 9 inches to 12 inches of rainfall, although they get the damp moisture which comes from the fogs that drift over the country, and I understand you get some dews here that also helps out the rainfall. You have got to have enough moisture stored up in the soil to carry the plant over the dry season. At first the plant root has not gone deep enough into the ground to draw upon the storehouse of moisture which is further down in the soil. If you can grow alfalfa in this district and can get a successful stand with a nurse crop, there is no reason why you cannot have first class alfalfa fields. If you have enough moisture to do that, you have enough moisture to grow alfalfa successfully.

Q. What would you say about sowing clover with fall wheat?

Prof. Linfield: It might do well in this country.

Q. I tried a little of it myself.

Prof. Linfield: Did it do all right?

A. I cannot say yet.

Prof. Linfield: I would not advise the sowing of it in the fall.

Mr. Bandmann: I heard a man present say that where you can raise grain you can raise alfalfa on the same ground. I raise grain without any moisture but I cannot raise alfalfa on that land. If you can tell me how I can raise alfalfa on dry land, why you will be doing a great blessing to a great many of us.

Mr. Wylie: All I would say is to try it again.

Mr. Bandmann: But it is expensive trying. I have tried that nineteen years ago.

Prof. Linfield: That doesn't prove anything. How many times?

Mr. Bandmann: Once.

Prof. Linfield: How many times did you try fruit growing? (Laughter.) I think a great many people fail with alfalfa because of the start. If you can get it over the first year it is all right. Alfalfa will not grow on land where there is no moisture without irrigation. If you will get the land in good condition, get it just as well as you can and sow as early as the frost will permit; cut it down, and later on in the season cut it again, and if you do not succeed, then I would say it is a question as to whether you can make a success of it or not. Try it. You do not need to put in any great amount,—20 pounds of seed will do.

Q. Are you sure that frost will kill the plant?

A. I am not sure.

A. I am sure it didn't for me; I have sown it in March and the frost never injured the alfalfa at all.

Q. How far out of the ground was that alfalfa when the frost came on?

A. It was in all stages in different parts of the field up to 1 inch high. The ground was frozen hard and solid, but the alfalfa wasn't injured. The seeding was subject to all the frosts of the spring.

Q. Would you advise sowing alfalfa following a cultivated crop? I have potatoes on a certain piece of land. Would you advise planting alfalfa on that ground next year without plowing the ground?

A. It depends on the condition of the land. If it is in good condition there is no necessity for plowing it.

Mr. Bandmann: I want to answer that gentleman about seeding alfalfa in the fall. Invariably it has been a failure in seeding clover in the fall. It always freezes up. I gave that up altogether.

Mr. Linfield: As a rule my advice is to sow it in the spring.

THE GROWING AND CURING OF ALFALFA.

F. B. Linfield, Director Montana Experiment Station.

Alfalfa (*Medicago sativa*) is among the oldest of cultivated plants. Apparently of Asiatic origin, it was used by the early Greeks and Romans and by them was carried into western Europe. From Spain it was carried into Mexico, South America and to California. From this latter district it has spread eastward into all the mountain and arid states, becoming the great forage plant of this section of the country. From northern Europe this plant was introduced into the eastern states many years ago under the name of lucern, but never became popular, nor had it much effect on the agriculture of that district except in a few places. Its success in the west has lately revived the interest in this plant in eastern states.

I can find no record of when this plant was introduced into Montana but it must have been in the early days of the settlement of the country. It is now found growing in nearly every farming valley in the state with greater or less success. The crop thrives wonderfully in the Yellowstone valley and its tributaries, from Livingston to the Dakota line; three good crops being obtained every season. The altitude in this valley is from 4,000 down to 2,000 feet above sea level. In the high valleys of the Gallatin, the Madison, the Beaverhead, the Judith, and Prickly Pear, ranging from 4,000 to 5,000 feet above sea level, alfalfa is the principal fodder crop, though in the Gallatin valley clover is grown extensively on the watered land, and the same is true of the Judith valley. In Cascade and Teton counties, which range from 3,500 to 4,000 feet above sea level, alfalfa does well under irrigation. In many places very good results are obtained on the dry bench lands without irrigation. Along the Milk river, a tributary of the Missouri and within 20 to 50 miles of the Canadian border, alfalfa is getting to be a very important fodder crop, though it occasionally winter-kills. Four to five tons of hay per acre is an average growth per season. Large yields of alfalfa seed of very fine quality are also obtained in this district. The altitude here is from 3,000 down to 1,900 feet at the Dakota line. West of the range in the Flathead and Bitterroot valley, and in the valleys tributary to Missoula, alfalfa is a paying crop though in this district the clovers are strong competitors.

Alfalfa is a perennial plant with an upright spreading growth. It belongs to the class of plants known as legumes, and is thus a nitrogen gatherer and soil enricher. It has a long and tough tap root which penetrates the ground for at least 12 to 15 feet and may, under favorable conditions, go much further than this. As the plant gets old and the crown enlarges; there may be several roots descending from this enlarged crown.

This long tap root gives to the plant a large area from which to draw its food supply, but from observation of the alfalfa, this root, it appeared to me, is also nature's provision for carrying the plant over dry seasons. The root will, if possible, go to the permanent water table, and from there, if necessary, will bring enough moisture to the surface to keep the crown alive even in very dry seasons. Fields of alfalfa where the stalk dries completely in the late summer and fall will grow luxuriantly and give a good crop next season if there has been abundant winter and spring rains to moisten the surface ground.

The young alfalfa plant comes up with a single upright stiff branching stalk. With repeated cuttings the crown enlarges and when cut off the cut stalk does not grow but new stalks start from the crown. In old alfalfa fields therefore, this crown may be quite large. If this crown is divided into several parts, as will be the result in disking, the crown is spread out and more room is afforded for new stalks to start, thus increasing the alfalfa crop. More than 100 stalks have been noted growing from one alfalfa plant.

The growth of the alfalfa is mainly from the terminal bud of the branches, which finally develops the flower and seed. The flower is in a loose head of deep purple color and the seeds are formed in a small spiral pod, which is produced from each individual flower of the head. In a warm dry climate, with sufficient moisture, alfalfa grows very rapidly. In the Yellowstone valley plants will reach 2 1-2 to 3 feet high by June 15th to 20th. Six weeks later the second crop will be two feet tall or over and in another six weeks the third crop is 18 inches high or over. In the higher valleys the growth will not be so rapid as this.

Soil and Water Supply.

Alfalfa does well on a great variety of soils ranging from sand to gumbo if other conditions are favorable. It does best, however, on a rich, deep, well drained and well aired loam soil

and subsoil.

Alfalfa requires abundance of water to grow well, but this water must not become stagnant in the soil. If the soil becomes water logged either from rise of ground water or from too much irrigation or excessive rainfall the alfalfa will not thrive and will gradually die out. If the water table remains for any length of time within 3 or 4 feet of the surface the alfalfa will kill out in a few seasons. For best results the water table should be 5 to 12 feet below the surface. If during the growing season water stands upon the alfalfa ground for 24 to 48 hours, the plant will usually die. If during the winter season water flows on the alfalfa land, thoroughly wetting the surface of the ground and forming ice over the surface which remains for a long time, the alfalfa will generally die. The alfalfa roots must have air and in our northern clime the plant must be protected from too great extremes of either drought or moisture during the winter season.

It is perhaps because of some of these conditions that alfalfa does so well on the irrigated farms of the west and fails so often in the humid east. Here the moisture can in a large measure be controlled, there it cannot. It is probable also that in the west most of the soil is deeper and more porous than is the soil of the humid region.

Climate and Alfalfa,

Alfalfa will grow most luxuriantly and give the greatest number of crops in a warm dry sunny district especially under irrigation. California, Arizona, and New Mexico report the largest yields and in (Old) Mexico it thrives wonderfully. Like the corn plant, however, it has a wide range of adaptability, and under man's fostering care it has moved farther, and farther north. Tests have shown conclusively that northern grown seed has greater resistance to northern climatic conditions than has seed grown in the south and warmer districts. This points the way to still further extension of this useful plant because as yet but a beginning has been made in growing seed in the north.

Observations are at hand that show conclusively that extreme cold of itself will not kill the plant. Neither will extreme drought if the tap root of the plant can get to subsoil moisture. When pasturing close in the fall and the crown is injured by the

tramping of the stock, the extreme winter cold is likely to injure the plant and even kill it. This would be more likely to occur if the ground when it froze up, was very dry or very wet. This would be a culmination of hard conditions which would make it difficult for the alfalfa to survive.

Preparing the Land.

In an irrigated country it is very important to have the land in proper condition for irrigating when seeding to alfalfa as it is a permanent crop. Thus all dead furrows should be filled in and all back furrows leveled off. The land is ploughed in wide lands and after being cultivated down is levelled by various styles of levellers or graders. A cheap and very efficient leveller is made of 2 by 6 inch or 2 by 8 inch plank about 12 feet long, fastened together at right angles and set on edge. This, when drawn over the ground cuts off all high places and scatters the earth in the lower places. With new ground considerable work is needed to get the land properly levelled and for that reason it is preferable to cultivate and crop the new land for a few seasons to grain before seeding to alfalfa. The grading is thus spread over two or three years and much less work will be required to get the land in shape for the alfalfa crop.

Seeds grow only when the soil is fine enough and compact enough to bring capillary water to the plant. With such a small seed as alfalfa, therefore, the soil should be in extra fine tilth, well pulverized, and fine at the surface and fairly well compacted below. The best condition of the soil is obtained probably by fall plowing, when the winter rain and snow will compact the soil while the frost pulverizes the surface. In the spring, as a rule, do not cultivate till the soil is dry enough to pulverize thoroughly, when the disk or spring tooth and drag harrow will soon put it into shape. For seeding on the dry bench lands, fall plowing is of especial importance, as it tends to better hold the snows and rains of winter and spring.

Seeding Alfalfa.

In this northern climate alfalfa should always be seeded in the spring, and about the time that wheat, oats or barley should be seeded. I do not think it is any more likely to be injured by the frost than are any of those grains.

Good plump seed only should be used as is advisable with the grain crops. Good seed will give a stronger and more vigorous

plant and this is very important if it is expected to produce a seed crop. Poor seed may give a good stand but such a practice if persisted in is likely to lead to deterioration.

Ten pounds of seed if properly distributed would put over fifty seeds on each square foot of an acre of ground. On an old alfalfa field it would be difficult to find 8 to 10 plants to each square foot. It would thus appear that ten pounds per acre would be ample seed and it is if properly seeded and the bed is in proper condition. However, these conditions are not always right and so 15 to 20 pounds of seed per acre is generally recommended. It would be very much better to spend more time in getting the land in good condition than to spend money for a larger amount of seed.

The best results are obtained by seeding with a drill, putting the seed deep enough to reach firm moist ground, which may range from one to two inches. Too deep seeding is likely to smother the plant or to give a weak plant.

The Nurse Crop for Alfalfa.

"Shall we seed with a nurse crop?" is a question frequently asked. When used in this sense a nurse crop is really a misnomer, as instead of nursing or helping the alfalfa it really injures it, using up the moisture and plant food needed by the alfalfa and shading and dwarfing it for the first season. The grain sown with the alfalfa, therefore, injures and does not help the new seeding. The question is really an economic one, viz: which will give the best returns from the land, seeding with a grain crop or seeding alone.

When seeded alone the alfalfa makes a vigorous growth and we are sure of a stand the first season. It becomes so firmly established that it usually gives one good crop of hay for that season on watered land and will give a maximum crop the next year. If seeded with a grain crop the alfalfa makes a very poor growth the first season and the stand may be uncertain unless watered properly. The next year but 1-2 to 2-3 of a crop will be obtained, so it is the third year before we get the full crop. Figured from this basis each farmer ought to be able to decide whether to seed with a grain crop or not.

The first stalk sent up by the alfalfa seed is single and small, which, if allowed to stand, soon matures and ceases to grow. If mown off when eight to ten inches high, several stalks start

from the crown, and the growth continues for a longer season. A second mowing yet further prolongs the season of growth and develops a stronger and more vigorous plant. The first cutting should be left as a mulch on the ground. The second may be saved for hay. If the later growth is pastured it should not be eaten close.

Irrigation.

The time and method of irrigating alfalfa will vary considerably in different valleys. In some places but two irrigations are given for the season, one the latter part of the first crop and the other the latter part of the second crop. In other districts the first crop is irrigated early and then irrigated again a few days before the second crop is cut. These irrigations, given a few days before cutting, give the succeeding crop a vigorous start. In some districts where water is scarce and the season dry the first irrigation is given very early in the spring when water could not be used for any other purpose. This is an economy in the use of water and often gives results equal to and sometimes better than later irrigation, especially in a dry season.

The Time to Cut Alfalfa.

In the higher valleys of the state but two crops of alfalfa are cut in the season; in the lower valleys three crops. The practice of the best farmers is to cut the alfalfa in early bloom. At this stage of growth the hay is more palatable and there is a smaller loss of leaves in handling and of small stalks in feeding.

The leaves and small stems on curing alfalfa are very brittle and easily broken off the stalk. As these leaves and stems are the most valuable part of the hay the crop must be handled so as to avoid this loss. The alfalfa should, therefore, be raked into windrows as soon as possible after it is cut and while yet green. If cut in the morning it may frequently be raked the same day or at least the next day. Then put in small cocks about a good forkful in each and allowed to remain here till fully cured. In this way it will cure without heating even if put up green. The leaves are saved and a slight rain does not injure the hay.

For the reasons stated above the hay should also be handled as carefully as possible and as little as possible in stacking. Save the leaves and fine stems. Some experiments made at

the Colorado Station showed that when cut late, raked when dry and carelessly handled in stacking, that more than fifty per cent of the valuable part of the alfalfa was lost before it got to the stock.

With modern improved methods it is estimated that it costs not to exceed \$1.00 per ton to cut and stack alfalfa hay in this state, and many report that they do it for less.

Alfalfa as a Feed.

Alfalfa is a very rich nitrogenous feed, in this respect being considerably richer than clover hay as will be seen from the accompanying table. Judging from the composition corn should make the best supplementary grain feed for fattening stock to be fed with the alfalfa, and could it be had at about an equal price it should be used in preference to the other grains. Corn, however, is not a profitable crop in many parts of Montana and the cost of grain if shipped into the state is usually excessive. Practically we have found that the local grown grains, wheat, barley and oats, are entirely satisfactory as grain feed.

Because of its cheapness, composition, palatability, and digestibility the alfalfa hay alone makes an excellent ration for young and growing stock, no grain being needed to get entirely satisfactory and economic gains. The table, which is taken from Farmers' Bulletin No. 215 of the U. S. Department of Agriculture and compiled from Henry's "Feeds and Feeding", will repay careful study.

AVERAGE PERCENTAGE COMPOSITION OF ALFALFA.

Condition of forage	Number of analyses	Water	Ash	Protein	Crude Fiber	Nitrogen free Extract	Ether extract (fat)
		Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Fresh alfalfa....	23	71.8	2.7	4.8	7.4	12.3	1.0
Fresh clover....	43	70.8	2.1	4.4	8.1	13.5	1.1
Alfalfa hay.....	21	8.4	7.4	14.3	25.9	42.7	2.2
Clover hay.....	38	15.3	6.2	12.3	24.8	38.1	3.3

AVERAGE DIGESTIBILITY OF ALFALFA AND RED CLOVER—Percentage.
(Experiments with ruminants.)

Condition of forage	Number of analyses	Protein	Crude Fiber	Nitrogen free extract	Either extract (fat)
		Per cent.	Per cent.	Per cent.	Per cent.
Fresh alfalfa.....	2	81	45	76	52
Fresh clover.....	2	67	53	78	65
Alfalfa hay.....	28	73	43	66	54
Clover hay.....	46	55	49	69	53

DIGESTIBLE NUTRIENTS IN 100 POUNDS.

Condition of Forage	Dry Matter in 100 Pounds.	Digestible Nutrient in 100 lbs.		
		Protein	Carbo-hydrates	Ether Extract
	Per cent.	Per cent.	Per cent.	Per cent.
Fresh alfalfa.....	28.2	3.9	22.7	0.5
Fresh clover.....	29.2	2.9	14.8	0.7
Alfalfa hay.....	91.6	10.44	39.6	1.2
Clover hay.....	84.7	6.8	35.8	1.7

The Market for Alfalfa.

The great market for alfalfa hay is as feed for stock on the farm. Considerable, however, is sold and used in the various large towns of the state, especially the mining towns.

Experience in the west has shown alfalfa to be valuable for feeding all classes of live stock, but it is especially valuable for young and growing stock and for milk cows. It is also used with success as a fattening ration. Experience shows that not more than 1-3 the grain ration is needed with the well-cured western alfalfa as is used and recommended by eastern feeders. On alfalfa alone I have handled cows that produced over 300 lbs of butter a year and 350 to 400 lbs have been produced on a maximum grain ration of four to six pounds during the fall and winter season. On a maximum grain ration at the end of the season of five pounds, a car of three-year-old steers at the Montana Experiment Station gained two pounds per day for over 100 days.

Experiments at Utah Experimental Station showed that alfalfa fed in proper quantity made an excellent ration for a horse. When in hard work 14 to 16 lbs of hay and about as much grain a day kept the work horses in better condition than the

same amount of timothy hay. Horses like alfalfa and if given all they will eat they will gorge themselves, but if fed intelligently it will keep horses in better condition at hard work than any other hay on the farm.

Much has been written about the value of alfalfa as a food for hogs. In my experience it is valuable as a supplementary food rather than as a main part of the ration. Alfalfa hay will maintain the life of a hog but will not maintain his weight. Alfalfa pasture, if the hogs are not allowed to dig in the ground and feed on the roots will furnish a maintenance ration for the hog but will not increase his weight nor fatten him as some claim. If allowed to feed upon the roots as well as upon the tops some gains will be made. If alfalfa, either as hay or pasture, is added to a small grain ration the hog will make very economic gains. I have known them, when on alfalfa pasture, to gain 1-2 lb per day on 1 lb of grain per day. Feeding on alfalfa, either hay or pasture, seems to develop an enormous digestive capacity in the hogs and when later put on a grain ration they will eat enormous quantities of grain and will make a very rapid gain for a time.

Alfalfa when fed with a grain ration enables the hog to make much better use of the grain ration. The extra returns as compared to a ration of grain alone often shows the alfalfa, when fed in this way, to be worth \$8.00 to \$10.00 per ton. Alfalfa leaves and stems also make a good supplementary feed for poultry, furnishing the necessary course and green feed.

Alfalfa would make an excellent soiling crop where this method of feeding stock is practiced. However, I question the economic value of thus feeding stock in the west.

As a pasture crop alfalfa has some advantages and some disadvantages. It grows early and rapidly in the spring and so gives early pasture. It grows rapidly through the season if kept well watered and so gives a lot of feed for the whole season. In a pasture field, continued tramping tends to kill it out. It is most valuable as a pasture when mixed with other grasses and makes about one-third of the stand. This is true also for another reason, viz: because it reduces the danger from bloat which is the great danger from pasturing alfalfa. This danger is reduced to a minimum by having mixed grass in the pasture with the alfalfa as noted above and by not turning the stock on it in the spring until the plant is somewhat mature. There is

less danger from the late summer and fall alfalfa, until the frost comes, when it increases, until the plant is thoroughly killed by the frost, when there is little danger.

The yield of alfalfa will vary with the climatic conditions and the length of the season. In the Yellowstone valley five to six tons from three cuttings is reported. In most of the other parts of the state, however, four to five tons would be an outside average one year with another. Such yields are obtained in the northern valleys of the state.

Alfalfa in the Rotation.

Alfalfa is a perennial with a tough tap root, thus land once seeded is very hard to break up. As this plant, like the clovers, feeds on the free nitrogen of the air through the nodules on the roots it is a soil enricher and therefore, a very valuable crop in a rotation. Experience has shown that where cereal grains are grown, a rotation with leguminous crops is absolutely essential if successful grain crops are to be obtained. If grain is grown in an alfalfa district and no other legume is available it will repay the expense to bring the alfalfa into the rotation with the cereal crop. Sugar beets, potatoes, and roots of all kinds also do very well on an old alfalfa field. As it is a plant that is slow to start and so persistent, a longer rotation is desired than where clover is grown. In breaking up an alfalfa field always plow the land in the fall.

Disking Alfalfa.

If the stand of alfalfa is thin the best plan is to disk it, running the disk nearly straight. This pulverizes and loosens the surface soil and splits and spreads the crown of the plant so that many new stalks start to grow, thus very much increasing the yield. It will also tend to destroy weeds and foreign grasses that may be in the field. This disking should be done always in the spring, never in the fall. The best time is just as the plant starts to grow in the spring. If the stand is very thin, large areas being bare, it will pay to reseed at the same time the land is disked, ordinarily, however, disking is all that is necessary. Some practice disking every year, or every second year, even when the stand is good, as they claim the alfalfa grows better and gives a thicker and finer crop.

Alfalfa Seed.

Within the past few years the growing of alfalfa seed has increased considerably in the state, and the reports show remarkable returns from this crop. The seed, too, is plump and of a very fine quality. I believe there is yet room for a large increase in this crop. Observations and experience, as well as science, would teach that the northern grown seed is going to be the best for us and for our neighbors to the east of us to use. It is in a measure acclimatized and will become more and more so with succeeding generations and thus better able to thrive under our local conditions and in this northern clime.

While it has not been tried in all sections I believe seed can be grown in any place where the alfalfa will grow if the crop is handled right. In Chouteau county, near Chinook, within forty miles of the Canadian border, on over 1,000 acres last year the average yield was about nine bushels per acre. The range reported was from one to seventeen bushels per acre. This was certainly a remarkable yield. The average gross return was nearly \$70.00 per acre for the seed at 12½c per pound. Whether to save the first or second crop for seed will depend on the climatic conditions and the length of the season. In most parts of Montana the first crop should be saved. Parts of the Yellowstone valley and the lower valleys to the west of the Rockies may be an exception to this and the second crops may do as well as the first.

The best crops of seed are obtained from rather a thin stand. Here the plant branches more, flowers more and has greater access to the light.

It is because of the more complete control of the moisture that an arid state is most successful in growing alfalfa seed. If given a plentiful water supply the alfalfa plant continues to grow, producing abundance of leaf and stem and flower, but few or none of the flowers set seed; conditions of growth are so favorable that there is apparently no need for seed. If the supply of water is limited, however, the vegetative growth is checked, the fruiting tendency is started and seed is produced. Whether to irrigate the seed crop or not, therefore, will depend upon the season. If the spring and early summer are damp no irrigation is needed. If the season is dry, however, an irrigation early in the season is advisable. The nature of the soil

and other local conditions will determine what it is best to do in the matter of irrigation, but we must not forget that the encouragement of excessive vegetative growth is opposed to seed formation. It is because of the lack of control of the moisture that the eastern states so often fail on the seed crop. The seed crop should be well ripened before cutting as all the seeds will then look well and be plump and of good color.

The Pests of Alfalfa.

The pests of alfalfa in Montana are not numerous or of very serious import. The dodder in our northern climate does not seem to thrive and soon kills out. In the lower valleys it may prove troublesome and is thus worth watching.

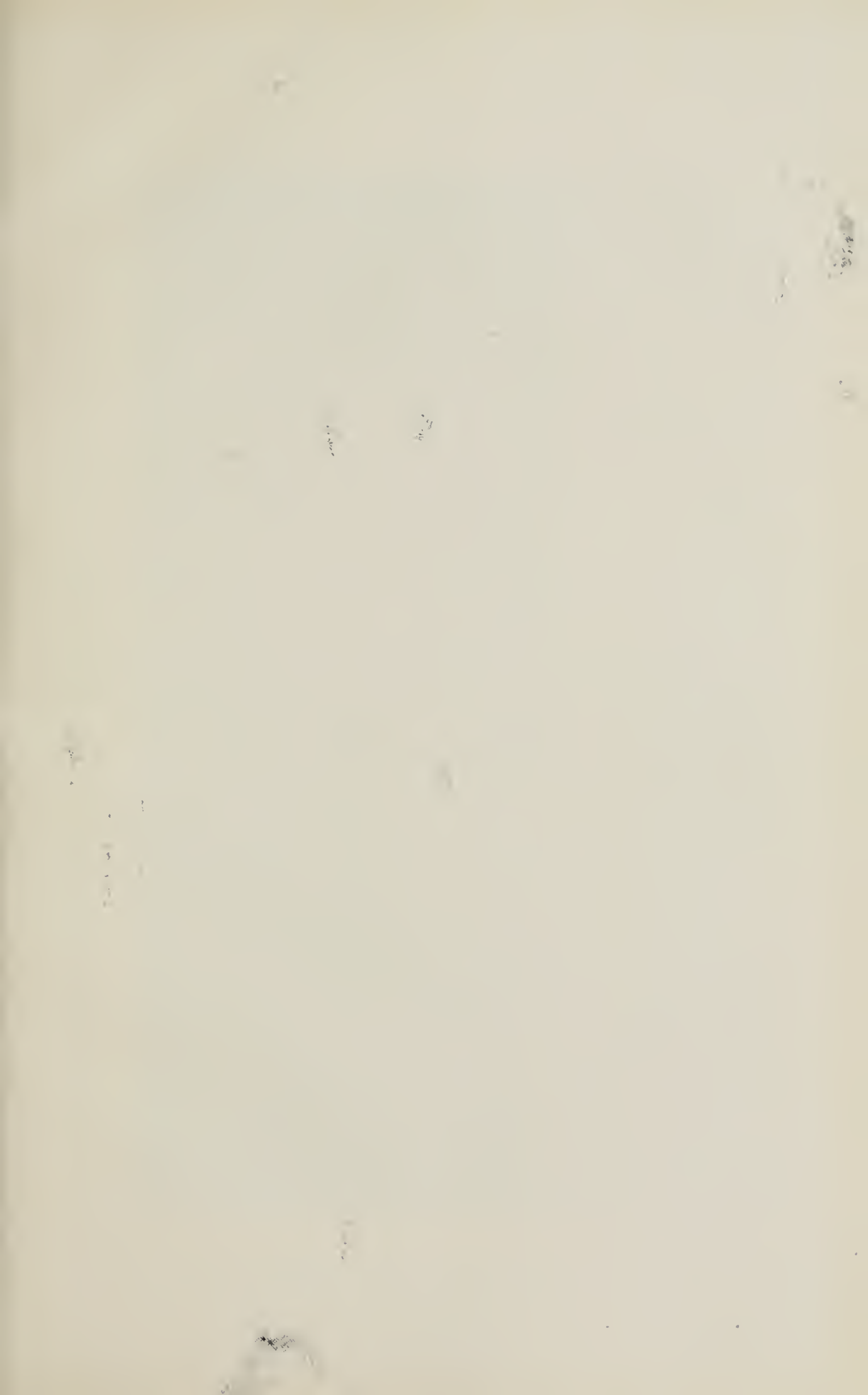
On the dry bench lands the gopher, prairie dogs, and squirrels are bad pests, as they dig in the ground and eat off the roots, thus destroying the plants. Systematic treatment with carbon bisulphide, two or three tablespoons full to a hole, which should be then tightly closed, will generally kill them, or a poison made of three cups of shorts, one cup of sugar and one teaspoon of strychnine put into the holes will also prove effective.

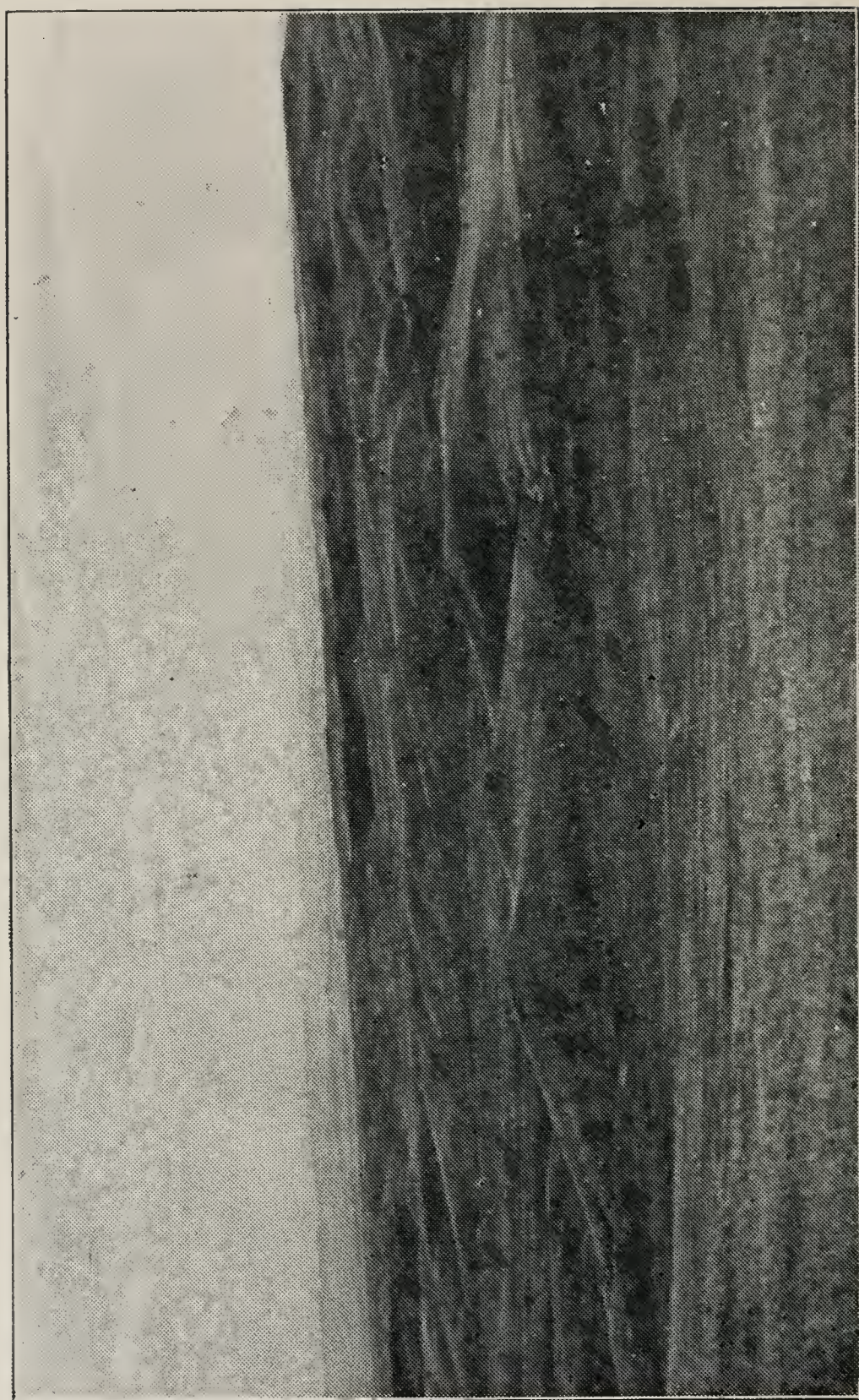
Grasshoppers and other insects are periodically troublesome in sparsely settled districts, especially to a seed crop. They seem to soon run their course, however, and do not appear to be troublesome after a year or two.

Winter-killing of Alfalfa.

Probably the most discouraging difficulty with alfalfa in the higher valleys and in the northern part of the state is winter-killing. If any one cause could be assigned for this it might be possible to suggest a remedy but the cause seems to be a complicated one. It is evident that it is not cold alone that is the cause, otherwise, all the fields in any district exposed to equal cold would be killed. As explained in another place extremes of dryness or of wetness accompanied by the cold may at all times kill. Too close pasturing, injuring the crown of the plant in the fall may also help to kill. Again seed produced in some warm southern district may not possess the hardiness desired for our more rigorous winters.

The plants may have been kept growing too late in the fall and the roots may not have had a chance to ripen and prepare





AN OPEN RANGE ON THE CROW RESERVATION.

for the winter; they are too soft and succulent and thus more susceptible to extreme cold.

In some places I believe protection might be afforded by pasturing little or none in the fall, thus leaving a considerable growth on the ground, which would collect the snow and afford a great protection to the plants.

No person ought to be discouraged by an occasional failure of this kind. Plough up the land, grow two or three crops of grain, the yields from which will surprise you, then seed again with northern grown seed. Such experiences were had in the Yellowstone valley and people said alfalfa will not do here; but that was in the early days. Now alfalfa is everywhere and failures are so few as to be never heard of. Even if there are occasional failure alfalfa is too good a crop to be given up. Try again. It will pay to seed for three or four good crops.

THE OPEN RANGE.

By Frank Spragg, Denton, Mont.

From the days of the Louisiana Purchase, from the days when our plains covered with vast forage resources supported antelope, deer and buffalo, and furnished a hunting ground for the savage Indian, until now, is a wonderful pilgrimage loaded down with "untold hardships, heart-breaking disappointments, and heroic struggles." It was with great sacrifice that the pioneer carried civilization into Montana. The first cattle were brought into the territory to furnish beef for mining camps. Early in the '60's small bunches were kept near St. Peter's Mission on Sun River and on ranches near mining camps over the territory, but they had to be herded closely on account of the Indians. The first beef drive from the territory was made to Salt Lake City in October, 1868. "Cattle raising as an industry did not come to be firmly established in Montana until it was realized that the herds, under the conditions prevailing, could spend the winters on the open range deriving nourishment alone from the grasses that had been cured by nature," and yet this is said to have been discovered by accident. "A freighter, driving bulls from Benton to Helena, was forced by a storm to abandon them. In the spring, much to his surprise, he found them alive and in much better condition than in the fall." The first range cattle business grew up in the

late '60's. The only question then was how can we get cattle enough to use what appeared to be an inexhaustible wealth? Eastern and English capital was invested. Until the Northern Pacific entered the territory, cattle were driven to points along the Union Pacific, or to Bismark and Fargo on the Northern Pacific. "All drives in those days started from Sun River valley and on account of the presence of Indians were very dangerous." In 1882, one outfit shipped 32 carloads from Billings to Chicago, where they averaged \$84.52 for 1,445 pounds. As the range stock might graze on the river bottoms and had full sway of the larger portion of our agricultural valleys, their numbers continued to increase and no one thought of feeding them hay during the winter. I've seen our creek bottoms, in the heat of summer, lined for miles with great herds of cattle. The representatives of each company built a few log cabins behind a big hill and "holed" up for the winter, combining in immense roundups the next summer. Then came a problem that the cowboy had not been asked to face before. He always had a revolver at his belt and was used to fighting range steers, wild beasts, and still more savage man. The Central States were being rapidly settled up and farmers not content with what they found there came on. They were looking for homes, a place to settle, and did not understand what was going on around them. The cowboy, like the railroad lawyer of to-day, was in the habit of fighting everything that came his way. So naturally he considered the new comers horse thieves and proceeded to dispose of them. Thus many a man has been shot, hung, or otherwise disposed of for no greater harm than the taking up of a piece of the public domain and starting a home. Gov. Toole in an address to the Pacific Northwest Wool Growers' Association said: "Looking backward, we are struck with the amount of ignorance and stupidity in the past. Time was when cattle were cured or killed by enchantment, when peasants wore charms for the ague, nailed horseshoes on the threshold to keep out witches, carried around in their pockets pieces of a coffin to ward off cramps, and tied red strings around the tails of their new milch cows to prevent the fairies from stealing the butter." Thus through many a misunderstanding has war been waged first between cowboys and settlers and later between sheepmen and cattlemen. Finally settlers came more rapidly, and the cowboys made a distinction between them and the horse thieves. Some of the settlers brought small bunches

of cattle with them, but the cowboys were not supposed to make the distinction. So if the cattle got out of sight the owners might never see them again. Some of the ranchers got sheep, but the cattlemen found themselves very greatly bothered with wolves. They put large quantities of poison in bits of meat, and the people found it difficult to keep their dogs. The ranchers put up hay for their stock as they had been used to do in the east, but the cattlemen laughed at them and did not awake to their folly, until the winter of 1886-87 had taken off 50 per cent of their cattle. Soon the big outfits got ranches and put up some hay. Then in the fall they gathered in such cattle as they considered needed help over the winter. As the range feed got less and less and the open range poorer and poorer, the stockmen were brought face to face with the situation. Sometimes they met and agreed to divide the ranges, each man to keep his stock on his own part, or sheepmen and cattlemen to stop on their own division. Sometimes a group of cattlemen agreed to hold a portion of the range by force of arms, and in some states sheepsholders have been hung and sheep driven over a cliff. Again a group of sheepmen agreed to feed out a cattle range. All this is but a glimpse of past events.

"Blessed with a matchless northern climate and embracing in its vast expanse of territory a bewildering variety of opportunity for successful enterprise, Montana stands today unmatched for rapid development, preeminent in golden promise and unparalleled in the inducements she has to offer to those of nerve, brains and capital necessary to success. The farmers have had an abundant harvest and stockmen have realized good prices for their stock. The past year produced high priced wool and the largest clip known. The day of the cattle king has gone. The ranchers he fought in the beginning have become numerous.

To the eastern farmer discouraged often by complete and successive failures, some of the results of the Montana rancher appear beyond belief, but the cold facts assert themselves on every hand. On what a few years ago was called "the Dry Ranch", out on one of the benches in Beaverhead county, 1,100 acres has recently produced 61,311 bushels of oats at 42 pounds to the bushel and at local prices was worth \$25,763. The threshing bill left nearly \$25,000 to pay the other expenses during the year. What the future demands is intensive instead of exten-

sive methods of operation. Outside perhaps of grain, you can scarcely mention a single agricultural product for which the demand is not greater than the supply, Though we have specially favored localities, like portions of the Judith basin, Cascade county, and the region around Kalispell where crops of grain, vegetables and even fine fruits are raised without irrigation, it is upon the artificial use of water, and the advantages under the irrigation law, that the great agricultural development of Montana depends. Just think what is going on around St. Marys lake and the Milk River country. When this is all irrigated, just think what the total number of stock raised on those ranches will be when compared with the herds of today! With the constant arrival of farmers who are crowded out in the east the present ranches are being broken up into smaller ones, and by closer cultivation of diversified crops, yields beyond the dreams of former owners are seen on every hand. The states on either side of us are being rapidly settled up, and the casual observer can hardly realize the vast numbers of eastern farmers who are stopping off in Montana. The value of land in the Gallatin valley has increased from fifty to sixty-five dollars within the past summer. Around Kalispell, they say some land is selling as high as \$125 per acre. When eastern people realize the possibility of farming much that is still range, the value of pasture will still increase. The cheap lands of Montana will never be cheaper.

As a result of all this, the area of the public land has decreased so steadily with the tide of western emigration that the stock industry, which once flourished on the magnificent pastures, is now driven into situations either too arid or too rugged for the husbandman's use. The natural tendency to increase rather than decrease the numbers of stock, has resulted in shortage of feed, and changed methods of operation. Where a few years ago cattle were almost unprovided for during the winter and taken from the range directly to eastern markets, they are now fed from two to four months during the year and are almost invariably fattened before being slaughtered. But let us see what the effect of all this has been on the stockman. Up to recently he has not owned his ranges. All the land he wanted was a place to cut hay, and another camp where he could water his stock. Besides this his other expenses were mainly labor, food and machinery. Now he finds that if he

does not own his ranges some one else will and he will go out of business. With the rising price of real estate, enormous capital must be invested in land, and the taxes he has to pay make the business unprofitable. He, like the farmer, must intensify and run a smaller business. He must raise more hay and finish his stock for the market. On account of the enormous yields of alfalfa, its fattening qualities, its increased value when fed to stock, and many other considerations, it is being marked out as the ideal forage crop. Many experiments have recently been carried on in regard to the feeding of stock. It has been proven that the increased gain will pay for the cost of feed and insure a higher price on the market. In the valleys of the Musselshell and Yellowstone rivers, about 500,000 sheep are fed each winter. On the Yellowstone it is found that two and three-year-old wethers, fed on four pounds of alfalfa a day, should gain 10 pounds in sixty days. At Bozeman, experiment shows that two-year-old wethers, fed 3 1-3 pounds of clover and 4-5 pounds of grain a day, will gain 22 2-3 pounds in 95 days. The change from the system of open range with no provision for winter feeding, to the system of pasturing animals on those ranges, to be fattened for the market or tided over the winter by the products of the farm, which has been going on since the winter of 1886-87, has taught stockmen a lesson. The new system is sure to advance rapidly in the near future, and the time will come when alternating pasturing and feeding will be the only system.

But though our valleys and creek bottoms were once pasture, though all the valuable upland bench south of Great Falls and south of Lewistown was once open to roving herds of stock, it is farmed now and we must spend no more time considering the history of conditions of those lands under the head of the open range. Let us consider the former conditions of what is now range only. Professor F. Lamson-Scribner, the man who was at the head of the grass and forage plant investigations of the Department of Agriculture for so many years, saw these ranges in the summer of 1883. He says that the native blue grasses were among the principal grasses of the country then. A rancher who came to the country shortly after 1880 describes the grasses of his benches as a thick mass of leaves inclined toward the southeast in the fall by the northwest winds, and being laid to the ground by the snows retained much of their

moisture until it had a chance to soak into the thirsty earth. His description led me to call it bluejoint. Many an old timer has told me that on the benches of the Judith Basin the bunch wheat grass nearly covered the ground, and they thought nothing of riding across the country with their feet dragging in the grass. I can remember, back in the eighties, when the mixed grasses of these benches, all headed out, waved in the wind like a field of grain. We know from abundant evidence that in those favored times large quantities of grass remained over from year to year, fell to the ground and was in time transformed into a mulch which thickening year by year protected the ground from the scorching sun, kept the rain from washing away the soil, and held the rain and snow water in check until large portions of it found its way into the underflow. We had nice springs then wherenow we find dry openings and gravel leading away. Grasses thrived then that cannot exist now.

But man was not content until he had so badly over-stocked these ranges that his own wealth began to die of starvation. In Nevada they say that the ranges are so severely grazed that the root crowns are injured and death results. Brush is so constantly nibbled that unable to produce leaves they finally succumb. In southeastern Oregon, the close biting has even exposed the grass roots to the sun. Large patches of that rich little bunch grass that grows near the mountains here has been completely ruined there, and it is hard to conceive of a process by which those ranges can be brought back to their former condition. But close feeding is not all. Grass on the hillside has been uprooted, and some of the heavily sodded uplands have been so completely tramped to pieces by stock and the finer particles blown away, or washed down by the passing showers, that what we have left is a pile of stones. And, let me say friends, you need not go out of this state of ours to find these conditions. Just take a look at the foothills on the south side of the Crazy mountains and you will find such conditions. But, all over our state the effect of the tramping of these immense herds of cattle is simply tremendous. Even the meadows were cut to pieces. Adjoining my father's place, in the Judith Basin, is a quarter section of one of the best native meadows I know. He could have bought this for a song when he settled there if he had considered it worth anything. The soil is naturally

moist and the range cattle had made it one mass of tracks four to six inches deep. It has since been fenced and leveled. I don't suppose you could buy it at any price. This gives us a good example of what misuse will do, and what may be again restored if the native grasses are taken care of and protected. The open range has not been protected, or the grasses allowed to go to seed, but cut to pieces. When plants with their roots are gone, the rain water has a good chance to wash the rich surface soil into streams and form gullies. If stockmen could but realize what it means to have every vestage of grass, every particle of mulch that could protect the soil taken away; if they could only realize what it means to have the soil robbed of its moisture; if they could comprehend the meaning of the extermination of their best grasses, they would not under any circumstance allow their ranges to be over-stocked.

In the same way as there has been a contest between sheepmen and cattlemen or among the various animals of a range for an existence, a war is being constantly waged among the plants that occupy a soil. You remove the good kinds and you give the thorny and bitter ones an excellent chance to grow, spread and raise seed. The grasses on the native pasture choke out the weeds. Remove the grasses by over-stocking and you have a weed patch. In many cases loco and other poisonous plants are thriving where they were not known before. If we are thus destined to raise what stock cannot eat, if we have killed out the larger portion of what stock can eat, how can we expect our ranges to support as much stock as formerly? We can not. It is estimated that in Nevada the ranges will support two-thirds of what they might have, had they been used rightly from the first. Down in Arizona, the ranges support from a tenth to a fourth as much as formerly.

Perhaps none of our range grasses have been exterminated, but on account of the close feeding and the tramping of stock, they have been so reduced in quantity as to be almost absent in some places. In their place has come the little curly blue grama or buffalo grass on the better upland soils, while in bad-land soils we have a waste. On the glacial drift northeast of the Highwood mountains, I have seen extensive patches covered with a "moss". Taking up a sod and tapping out the ground, I have found in this felt of "moss" roots, all the old dead roots and crowns of a once heavy grama sod. Depending upon the

amount of over-stocking, the foliage of our benches today ranges from a thick mass of bluejoint leaves on down through all the gradations of a grama sod to where even this grass has succumbed to a "moss" and desert conditions prevail. That we may understand what may yet be in store for us, I will mention the case of the Australian salt bush. It was imported and planted in South Africa. There it spread far and wide over the sheep ranges until it had produced seed abundantly. Meanwhile the greed of the Australian sheepman had led him to over-stock his ranges until the salt bush, which formerly had formed a very large portion of the forage on many a dry range, was almost destroyed. They were obliged to reseed their ranges with Australian salt bush seed imported from South Africa.

That we may see what over-stocking means to Arizona, I will give a sketch of what the director of the Arizona Station says, In the memory of some of the oldest settlers there, the hills and valleys alike were covered with such a tangle of grasses that when it rained on the uplands the water could make but slow progress in its downward course, and sinking into the ground largely made its way into the under-flow. Much of the moisture was utilized by growing plants. When severe storms occurred, the resulting floods with the silt they might bring down from the uplands were spread over the lowlands by the abundant grasses there and the silt left to enrich the land. It was into these luxuriant wild pastures that the cattlemen of thirty years ago drove their stock. The multiplication of the smaller herds with their natural increase, together with the restricted sales on cattle due to low prices in the middle eighties, soon caused the ranges even in favorable years to be stocked to their utmost capacity. In seasons of scarcity when feed was short, the cattle devoured every vestige of growth on the plains and still perished from starvation in large numbers. The cattle in their wanderings between the higher and lower lands wore paths several inches below the general surface. The prevailing winds blew away the dust, and the rains gullying the trails gathered in destructive freshets lower down. The grasses of the bottoms, having been exhausted by the starving cattle, were no longer able to withstand the rush of the flood. Through what were formerly the most luxuriantly grassy regions of the country, this gullying process began on a large scale. The

water being destined now to follow these channels, no longer spread over the level bottoms-and no longer could the former grasses grow there. At Solomonville one of these gullies, which has cut its way up the valley, is fifty feet across and ten feet deep. From this point it is stated to extend southward some sixty miles, with side washes reaching out to yearly increasing distance on either side. As a result of all this, the stock industry is almost exterminated, the number of cattle has fallen off 75 to 90 per cent, and the commercial value of the ranges has been destroyed.

Since 1899 the government has been experimenting on the question of range improvement at Highland, South Dakota, and at Abilene, Texas, till now we have some data and many theories on the subject. At Highland they have a series of plats planted to the various kinds of grass and hay. The ones that they find the most promising are the bluejoints and blue grasses native to Montana. Now these are the very grasses that once occupied our native benches. Hence it is plain that the grasses to plant are our best native varieties. These grasses are found scattered over our ranges, and if they could be allowed to go to seed each year, they may in time reseed themselves. But in this connection we must not forget the question of mulch. As long as every vestige of growth is eaten off of the range each year, the rain and snow water will largely run off the surface and the bare ground, exposed to the sun, will dry up. We cannot expect these ranker grasses to thrive. If, however, a part of the grass is left each year, a mulch will in time form over the surface and the moisture held in the ground by it will enable the ranker grasses to grow, if they can be allowed to seed. In this connection, the work at Abilene, Texas, is on the methods of range improvement. As a result of the cultivation and rest given, the grazing capacity of their lands has been increased from the beginning. During the third year, the manager found it possible to keep 100 head of cattle on a section of land that the first year furnished feed for only forty. He divided the section into fields and pastured them in rotation, thus allowing all the grass to seed sometime during the year. He concludes "(1) that it will pay the farmer and stockman to cultivate their pastures with a disk; (2) that it will pay them to rest their pastures periodically during the season, when the grass seeds are maturing and falling to the ground." The seed too must

be given a chance to grow. The young plants need at least a year's rest. Too close biting them will kill them before they get rooted. It is best to aid the seed to secure a lodgement in the soil. This may be done with a disk set so as not to tear up the ground, or by driving stock over the land after the seed has been broadcasted. The best results will be obtained if the re-seeding can be done while the ground is moist or before a rain in the spring. It may take several years to restore a range to its former conditions, but during the time it is necessary to manage the range with care that the young plants may not be killed out. Cutting deeply with a disk set straight so as not to tear up the ground, will aid the water to moisten the roots. If the harrow can be run across the course of the water or on the level, greater results may be obtained. Now the water runs off the surface too easily. Rank grasses once hindered the water from going directly into the ravine. Disking will aid the ground to take up water, but often, as in the case of steep slopes, the water still runs off the surface too easily. Furrows plowed from either side of little draws on a fall of say an inch to the rod, would help hold the water on the land, and thus give it more chance to soak in.

There are people who have recently settled in nooks of the open range away from the mountains and off of any stream, who have come into control and fenced a piece of range land, which is being allowed to reseed and grow up during the years when the numbers of their cattle are small. Some day this will pasture twice as many as it could today. These people are obtaining hay from *bromus inermis*, fall rye and the native grasses. When eastern people come to realize such possibilities as this, real estate even on the open range will rise from a present value of say \$1.50 to ten or fifteen dollars an acre, and should national irrigation be able to reach it, the price as we have seen would advance to \$50, \$70, or even \$100, in some places.

But the question might be asked, will not all this range land be farmed? Is it necessary that we do anything? Why not leave it to the eastern man who buys it? But let us think of the eastern half of Montana. Is it reasonable to think that very much of it will be irrigated? How much of it will produce good crops without irrigation? We have large tracts of just such land scattered over the whole state. The twelfth census shows that of the 145,310 square miles in Montana only about one-

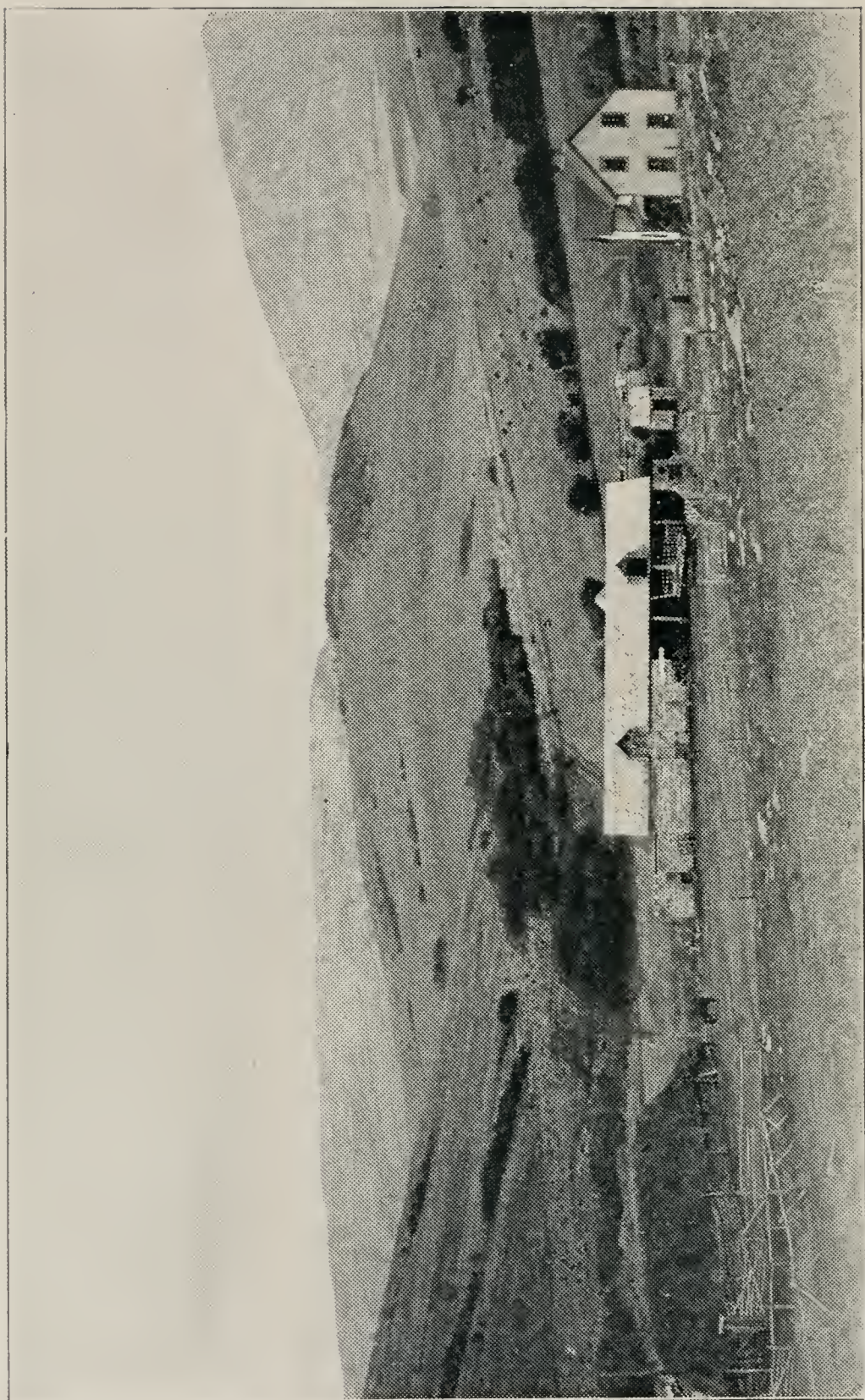
eighth of it is farmed, and classifying these according to the principal income, we find the value of the stock ranches to be 70 per cent, hay and grain ranches 20 per cent. This leaves 10 per cent for all other ranches. The census also shows that of the total value of ranch products hay and grain forms 56 per cent. This shows plainly that Montana is a stock country. But let us think again. Only one-eighth of the land in Montana farmed! There will always be range.

While enumerating the causes of range destruction, we noticed that so long as we have open range, so long as each rancher must make an effort to get his "share", we have trouble. But as things are drifting now, it is only a matter of time when all the public domain will be owned or leased by the ranchers. If the rent can be reasonable enough so as not to drive out the smaller owners, they will be given an incentive to adopt methods for the betterment of their holdings, and knowing that they and not some one else will get the benefit of their endeavors, they will make the subject a study and year by year the ranges will be enabled to support more and more stock. If the range grasses are to continue to grow we must allow them to seed. There is no doubt but what a range may be pastured by a few animals the year around, but if it is to be stocked to its full capacity, it must be divided and only a portion of it fed at a time. In parts of Montana, Wyoming, and western South Dakota it is customary to fence large areas of land on the general mesa or prairie in order to protect them during the growing season. This is a move in the right direction. Like any pasture, the open range can provide forage for only a limited number of stock. The Nevada station in remarking on the use given land under private control says that the exhaustion caused by over-stocking is not as widespread. "As sheep increase, too many may be put on one section, but in the main the sheepman knows how many sheep his range will carry without injury, and does not exceed that number greatly." The intelligent rancher knows that the tendency of over-stocking his own land is to force him out of business.

When the average man begins to think of restoring an exhausted range, he is apt to imagine that somewhere on earth, in Australia, or may be in Siberia, there is some wonderful forage plant which can be made to grow on his range high up on the mountain side, low down in the shady valleys, and out on the

open prairie, that will furnish abundant food for his stock. But allow me to say that this is just as possible as it is to find a patent medicine which will really cure all diseases. A Socialist has suggested that reseeding should be undertaken by the general government, that seed should be collected, enormous grass farms planted, that the seed raised should be scattered far and wide over the open ranges, and that it should be paid for by taxation on the people. Granted that reseeding is wise and necessary, what class of men are so familiar with the ranges or so well qualified for the work, both from self interest and a knowledge of conditions, as the ranchers themselves? Who can be more justly asked to pay for the reseeding? The general government can and is trying to aid them in this work.

In summing up, I have outlined to you what magnificent growths of grass once grew on our ranges. I have enumerated the causes of range destruction and shown that they are still acting. That you might see what may come, I have outlined the present conditions of Arizona. I have shown that the government is doing all that it can to gather information on this important subject and given some of the results of experiment. I have mentioned cases where people are improving their ranges, and shown that there will always be range. As the ranchers are the most interested, they should make an effort to check the progress of destruction.



THE VALLEY HOME AND THE ADJOINING RANGE.

Soil Fertility and Irrigation.

FERTILITY OF SOIL.

John M. Robinson, Bozeman, Mont.

In the early attempt at agriculture in this state, the land was new and fertile. Our opportunities were indeed great, and our prospects for financial gain unexcelled. But the tiller of the soil had many inconveniences. Implements of all kinds were excessively high and difficult to obtain at any price. A plow which the writer had the privilege of using was entirely of home manufacture. The beam and handles were made of native fir; the mould board of old wagon tires, and the shear of the blade of an old whip saw. The plow weighed about 200 pounds and cost \$125. Four yoke of oxen constituted the motor power and one driver and a man at the handles constituted the corps of engineers. Two acres per day was a good day's work.

Seed wheat cost from \$8 to \$10 per bushel, and other cereals for seed in about the same proportion. I call to mind when onion seed sold for its equal weight in gold dust, the onion seed being placed on one scale pan and the gold dust in the other. Large yields were not the rule in those days. The high price of labor, inadequate and expensive machinery and the inexperience of the farmer were serious drawbacks to good farming. The soil did not receive proper treatment. hence poor yields.

By the time most of these obstacles had been overcome it was evident that constant cropping was impoverishing the soil.

The system of summer fallowing was then introduced, The results exceeded all expectations. The yields of grain exceeded anything in the history of the state up to that date. This method of farming soon became general and is largely practiced up to this date.

After the establishment of the experiment station in Bozeman,

the director of the station maintained that the summer fallow system was a great waste of land, as one-half of the farm was idle each year.

It was also discovered that land that was summer fallowed, cropped and irrigated for a period of years was losing its humus, thus causing it to bake, and to decrease the yield of grain; it also washed badly, was hard to cultivate, and to bring into prime condition for seeding.

Finally some thinking farmers began seeding to clover, and demonstrated that clover could be successfully grown and that it was invaluable to build up worn and depleted soils.

My first experience was in 1893. I had 70 acres on which I had grown clover for two years. I raised on this land 110 bushels of oats to the acre. The next year a portion of this tract raised 42 bushels of fife wheat to the acre, and the next year on spring plowing 76 bushels of barley and 72 bushels of wheat per acre were grown,

Before the clover was sown on this piece of land a long continued system of summer fallowing had brought the yield down to a little more than half of the yield obtained after it had been sown to clover. Further, the soil is less liable to bake and is much easier to cultivate in every way.

These experiments thoroughly convinced me and others who were trying the same system, of the great advantage of the clover; and now the sowing of clover is becoming universal where an abundance of water can be had for irrigating purposes. Here too I would like to add that we can make the water do nearly double duty under this new system of farming.

In preparing the soil for any crop I would endeavor to plow the land while it is in a condition to be most thoroughly pulverized afterwards, so that the young plant in its efforts to reach the surface will meet with but few obstacles, and the young rootlets in their ramifications through the soil in search of food will find no obstacle to impede their progress. Such a soil in the best of condition to hold in solution the nourishment necessary for healthy growth. If the young plant or germination seed could crush the clods or otherwise pulverize them as the cow, horse or other animal can grind their food then we would fail to see the necessity for such careful preparation of the soil. These two cases are so nearly parallel in effect that we cannot fail to note results; and yet with all these provisions of nature in favor

of animals, experience has taught us that in most cases it is profitable to pulverize the food for the animal.

Not only do we find well pulverized soil conducive to plant growth but we also find it a great conserver of moisture. Through such soils the drying wind cannot so easily penetrate, and the absorption of falling rain or irrigation will be more rapid and thorough and evaporation will not be so rapid because by recent cultivation the capillarity of the soil has been measurably destroyed.

For example, take two plats of land adjoining each other and of precisely the same character; plow at the same date. On one of these thoroughly pulverize the plowed surface and continue a shallow cultivation, especially after each succeeding rain, and you will find the cultivated area even after long drought to contain sufficient moisture to germinate grain and to continue growth, while the uncultivated plat will not germinate even a single grain. By taking advantage of this condition of soil culture many of our semi-arid foothill farms, where water cannot be procured for irrigation, profitable crops of grain, alfalfa and clover would grow. This semi-arid farming necessitates the continuation of the summer fallow system, but where water can be procured it will soon be a thing of the past.

Experience has taught us that in our locality early plowing has resulted in the most crop production.

It is contended that by early plowing the soil can be more thoroughly pulverized; that moisture can be conserved; that the plowed soil will become more compact with the subsoil and that the watering of the soil will become more perfect.

For dry land farming, plow shallow—not to exceed three or four inches deep and keep the top surface well pulverized or cultivated after any rains which may fall until seeded. We claim that the shallow pulverized surface acts as a mulch and makes the necessary seed bed for germination through which the rootlets pass into moist soil below from which the plant draws nourishment.

DISCUSSION IN DISTRICT NO. 3.

Question. Where and when did you note that the land was diminishing to such an extent that summer fallowing was required?

John M. Robinson: On my farm in the year 1898.

Q. Who was Director at that time? (When summer fallowing was discouraged?)

Answer. Professor S. Emery was director of U. S. Experimental station at Bozeman.

Q. What is the use of humus in the soil? .

Ans. Humus is the fiber in the soil, or dead organic matter. Its presence renders the soil more pliable, that is, less liable to bake after being cultivated or irrigated, permits moisture to penetrate the soil more readily, assists in the chemical disintegration of the plant food contained in the soil, and is the chief element that aids in the development of bacteria, so essential to the preparation of plant food in the soil.

Q. When the soil is so dry that you cannot grow clover successfully what plant will you grow as a soiling crop?

Ans. Alfalfa will grow on soil that is very much too dry for clover, particularly if it gets a good start and goes safely through the first season.

Q. What kind of soil have you in the Gallatin valley?

Ans. We have a great variety of soils, but they are principally loam with clay sub-soil.

Q. Is there any alkali in it?

Ans. Alkali is present in all of our soils but not in sufficient quantities to injure plant growth only where it is deposited on or near the surface, by the action of water coming through the soil from below, or sub-irrigation. Relatively speaking, however, there is little alkali in the soils of Gallatin valley.

Q. What are the methods of getting rid of alkali?

Ans. Some success has been attended by flooding or washing it off, but deep drainage seems to be the only reliable method that can be recommended. The drainage is a permanent and thorough cure.

Q. What is the cause and prevention of smut in wheat?

Ans. Smut in grain is caused by a fungus growth which starts from a spore (seed) which is usually on the grain. When such infected grain is sown the spore germinates with the grain and grows up through the stalk of the grain and into the grain formed in the head of the plant. The smut is a parasite feeding upon the substance of the grain and produces a multitude of its own seeds (spores) where the grain ought to be. Two kinds of smut are commonly recognized; the loose smut and the stinking smut or bunt. Smut can be prevented in many ways. Im-

mersed in weak lye proved very successful. Much less expense is incurred by the use of vitrol, formalin or hot water. Directions for the use of either of these are so easily obtained that it is not necessary to repeat here. See 1st Annual Report of the Farmers' Institute, Page 125-129.

Q. Did you ever use lime in treating your wheat for smut?

Ans. I have never used lime. I would think too much lime would destroy the germ of most kinds of grain. I used lye reduced less than one-half and destroyed wheat so that it would not grow.

Q. Can you get a better stand of alfalfa with or without a nurse crop?

Ans. It is generally conceded that a better and more vigorous growth can be obtained without a nurse crop.

Q. Do you claim that late irrigation kills alfalfa?

Ans. In some soil late irrigation will kill alfalfa. This occurs in heavy soil where under drainage is not good. It depends somewhat on how soon after the irrigation the ground freezes up. Alfalfa should not as a rule be irrigated later than two or four weeks before the ground freezes up for the winter.

Q. Will fall rye produce seed?

Ans. Fall or winter rye sown in the fall months produces from 25 to 45 bushels of seed per acre next season. Fall grain sown in the spring will not give a satisfactory grain crop.

Q. Don't you sow any timothy with your clover over there in the Gallatin?

Ans. We do not sow timothy with clover when we want the hay for fattening stock or rotation purposes.

Q. How much do you carry at a load with a bull rake?

Ans. About 600 pounds.

Q. Is it difficult to get across irrigating ditches with the rake?

Ans. Not over the ordinary irrigation ditches.

Q. What distance do you haul the hay?

Ans. About one-fourth of a mile.

Q. Is green alfalfa more nourishing than black, stack burned alfalfa?

Ans. The experience of many feeders are that stock relish and fatten faster on dark alfalfa hay than when cured green, but this will depend very much on the condition of the hay.

Fred Ellinghouse: That would apply to cattle and not to horses. Black alfalfa is certainly hard on horses.

Q. What effect did black alfalfa hay have upon your horses?

Ans. Black alfalfa or black clover hay if fed to horses will give them the heaves. Green alfalfa in my opinion produces as much milk and as much fat as the black alfalfa.

Q. Do you recommend making up black alfalfa hay in preference to green?

Ans. Until more definite results could be obtained, I would advise stacking so as to have the hay a bright green color.

Q. Has alfalfa been stored by the silo method?

Mr. Robinson: I have not heard of any in Montana. It has in Colorado and California.

A Voice: The only silo in the state is at the Penitentiary, Deer Lodge. They report satisfactory results with alfalfa.

Q. Would you advise disking every spring?

Mr. Robinson: Disking alfalfa has been attended with very satisfactory results, but I could not advise how often it should be done. It will vary with the conditions of the crop. If the stand was not good, or the crop was not thriving well, I would try disking every year for a time.

Q. Is alfalfa as good a soil renovator as clover?

Ans. It most certainly is. However, being a perennial plant, slower to start and harder to plow up, it does not fit into as short a rotation as does the clover.

Q. Is it better to sow clover at the same time with the grain or at a different time?

Ans. Would advise sowing at the same time.

Q. How does alfalfa behave in alkali soils such as we have in the Beaverhead valley?

Ans. Early irrigation on alkali soil is likely to kill alfalfa. The ground should be warm before the water is turned on. It is better to let the land suffer than to irrigate too early. In the spring you must be sure that the alfalfa on the alkali ground needs water before applying it. If the winter and spring are very dry there would be no objection to watering the alfalfa quite early in the spring. If the spring was cold and wet, irrigating the alfalfa would be likely to still further delay the growth of the crop. There are different kinds of alkali soil. Some will grow grain well for two or three years and should then be sown with either timothy or alfalfa. The irrigation of

the grain on porous soil frequently washes out the alkali so that the alfalfa will grow better. Manure will also tend to neutralize the effect of the alkali.

A Voice: I find that 25 pounds of alfalfa seed are required per acre.

Ans. I believe that it would be much better to spend extra time on the preparation of the land than to spend so much for seed. The alfalfa has a small seed and must have a thoroughly fine seed bed with the ground fairly well compact below so that the moisture will be carried from below by capillarity to the seed. If the condition of the soil is made right 15 pounds of seed will do better than 25 pounds without this preparation of the seed bed.

Q. Why is it that clover will not stand well in this valley? (Twin Bridges.)

Ans. Clover is a bi-ennial plant in much of our northern country unless well protected over the second winter by snow lodging on the ground. Where the snow does not lodge two crops of clover is all that will be obtained unless the crop re-seeds itself.

Q. Why does not timothy do better here?

Ans. It is hard to tell without knowing more of the conditions. Timothy does best on a damp soil where there is no alkali. A rich soil is best but timothy will grow on a great variety of soils where the moisture and other conditions are correct.

Q. I find that I can raise the best clover near the mountains. Has the snowfall anything to do with this?

Ans. It undoubtedly has. Clover likes a little more moisture both in air and soil than does the alfalfa. The snowfall near the mountains will also afford winter protection.

Q. What is the agency of the nitrogen gathering organisms?

Ans. The nitrogen gathering organism is a microscopic parasite which fastens itself to the roots of clover and allied plants forming nodules on the roots. These organisms have the ability of feeding on the free nitrogen of the air (the air is four-fifths nitrogen and one-fifth oxygen gas) and combining it with other elements or compounds in the nodule. Upon this gathered nitrogen the clover and allied plants feed. A large amount of this combined nitrogen is also stored in the roots and as these decay the soil is very much enriched.

Q. Have you had any experience with late irrigation of alfalfa?

Remark: Late irrigation is the proper procedure at Twin Bridges judging from my experience last year.

Q. Did your soil contain a great deal of organic matter or was it heavy clay soil?

P. Carney: Yes, it was clay and rather rich. No gravel in it.

Q. Was your soil in which the alfalfa was killed by late fall irrigation sandy or gravelly and poor in humus.

N. J. Linder: Yes.

Fred Mercer: If the winter is alternately warm and then cold alfalfa may be killed out. If continuously cold or warm, alfalfa will not be killed out.

Q. Is it practicable for the little rancher to stack with a bull rake rather than use a wagon?

Mr. Robinson: Where not more than 50 tons are grown I would not advise the use of Bull rake and stacker.

Q. Is not there danger of alfalfa or clover taking fire when stacked too green?

Ans. I have never seen combustion result from stacking over-green hay but I have seen it burned so as to render it unfit for feeding purposes. There are some reliable reports from Kansas, however, where alfalfa stacks have been destroyed by the heating of alfalfa put up too green.

Q. How much did you give those steers per day?

Ans. About 30 pounds each.

Q. Is it not a detriment in feeding beef cattle to change from one kind of hay to another?

Ans. It is claimed by experienced feeders that radical changes are detrimental. Slight and gradual changes are usually beneficial as the animal seems to relish his feed better.

Q. Was the wheat which you fed ground up?

Ans. We fed whole grain for sheep and chopped feed for hogs and cattle.

Q. Can barley be raised successfully in this valley? (Twin Bridges.)

N. J. Callahan: I have tried to raise two-rowed barley but with no pronounced success.

J. M. Page: Two-rowed barley was raised here very successfully in bottom land two years ago.

Q. Has it been found that leguminous plants thrive better the second year after the nitrifying organisms were introduced?

Ans. Experience on this point is limited. It would depend somewhat on the number introduced and the vigor of their growth on the plant.

Q. Is it beneficial to mix timothy with alfalfa?

Mr. Robinson: Not for fattening purposes in my experience.

Q. Do you plow in the first or second crop of alfalfa and use it as a mulch crop?

Ans. In the Gallatin valley we take the clover crop all off for one or two years and then plow the stubble under, that is without any growth. Even then we often find the soil too strong for a successful crop of grain.

Q. Is alfalfa harder to plow under than clover?

Ans. Alfalfa is generally let stand for several years and is much more difficult to plow under because of the large tough tap root.

Q. Can you plow up alfalfa?

Ans. Yes, with a sharp pointed plow the root can be cut off at the usual plowing depth.

Q. Has alfalfa been used on bench land merely for pasturage?

Ans. I have heard of a very limited amount of dry bench land being in alfalfa and used exclusively for pasture.

CLOVER AND SOIL FERTILITY.

By W. W. Wylie, Bozeman, Mont.

The time was when we thought that our Montana lands would go on producing excellent crops without cessation; but we have now come to the conclusion that something else must be done. In one of the papers just read the gentleman mentioned the fact that the last crop was quite a good one, but that all the yields were diminishing. A portion of the nutriment of plants comes from the soil and it is the history of every agricultural locality, and it is the same here, that when these food elements are consumed by the constant raising of one crop there must be something done besides summer fallowing to bring back this nutriment that is exhausted through the raising of any single crop. There are a few crops, like wheat and flax and barley, and in a

less degree, oats and timothy, that will exhaust any soil. There is no question about it. Again there are other crops that when alternately raised with any of those mentioned will bring back to the soil a number of the food elements in greater amounts than they have been removed. In the Gallatin valley we have come to raise clover every alternate year. I would not mention this if the conditions were not equally favorable in this locality, in fact, in any place in Montana. It matters not whether it is dry-land farming or irrigation farming, though of course the clover raising is somewhat better under an irrigation system. Our plan is this: For summer fallow I always plow in June or before. Instructions are never to plow after the fourth of July. Experience has shown me that summer fallowing begun later than July might just as well be left undone; but where done in June we find that we get increased crop returns the next year. When necessary to keep down the weeds the land should be cultivated. But to summer fallow every year in order to keep our soil perpetually in good condition requires us to have twice as much land as we are using. For instance, a man with a 300-acre field sowed 150 acres this year and summer fallowed 150. He then sowed next year the 150 acres that was summer fallowed that which he had grain on last. When we estimated how much we got from a crop we always had to divide it by two. If a man came from the east, for instance, and inquired what was the profit per acre, if it was \$36 an acre, if we were honest with him we would say that it was only \$18 an acre. At that time, as you rode over the valley, you would see half the land black, half in stubble,—half summer fallowed and half with stubble of the crop taken off. Now you don't see the black land any more; at least, only in very few cases. It is all in clover. Our valley is now filled up with sheep and cattle in the winter time; every farmer is feeding something, and the consequence is that we have doubled our profits. We are getting, at a very conservative estimate, fifteen dollars an acre off our land a year that we otherwise were letting lie in summer fallowing. As a result we are getting money at the time we didn't use to get it; we get money at the tax-paying time, grain-selling time, while under a system of grain growing farmers only settle their bills once a year. Our business is better and our town is growing perhaps better than any town in the state, and not because we have any

factory or pay-roll; it is because of the prosperity of the farmers. Most of them are building homes in the town and running their farms just the same. And you can scarcely buy a good average farm in the Gallatin valley today for sixty dollars an acre. Any of them that want to continue farming under these improved conditions will not sell their farms at all, because they say they cannot invest their money better than in the farm. Two years ago my brother and I spent the winter in the Republic of Mexico. He was sick and thought it would be necessary for him to leave the state, so he bought a home in California. When we started out he said: "I don't believe I will sell my farm for less than forty dollars an acre." After seeing the land in Colorado and getting down to Mexico, he said forty-five dollars an acre. I said, "I guess you can get that". He said, "I haven't heard of any selling for that". I said, "No, I haven't either, and I haven't heard of any for sale". When we got home a real estate man offered him fifty dollars an acre, and he has since refused sixty-five dollars an acre. That is the way conditions have changed, and I say it is because we have been raising clover. And if you will do it, you will not have these poor cattle which we saw on the range. It made me feel very badly yesterday and the day before to see the cattle that we saw between Collins and Choteau. We have nothing of that kind in the Gallatin valley. We go on the principle that an animal will grow from the day it is born until it goes to the block. The people who are selling cattle here are wondering, perhaps, why they are not getting as good prices as they used to. It is because cattle of a better quality are growing up in Montana under those other conditions. Our market now is Seattle, and it is going to be Seattle more and more since this war has begun, unfortunate as it is; yet there is no question but that the farmers of Montana, more perhaps than the farmers in any state in the union, are going to profit by this unfortunate condition.

The clover crop, I only raise to enrich the soil, and what I do hundreds of the farmers of the Gallatin valley do, and they are going to do it in the Flathead country. They were very anxious to have us talk on this subject, and they did not think they could raise clover. They are all going to try it; so I think next summer or in two years, if we should visit there again, we will see altogether a changed condition, and I hope it will be so in your county.

DISCUSSION AT BELT.

Mr. Daniel Payne: I would like to call on some of the gentlemen to give us a little information on the wild oat question. I want to know whether there is such a thing as tame oats turning to wild oats.

Mr. Willson: Mr. Chairman, I would like to tell you my experience in reference to the wild oat proposition. We broke up some ground a number of years ago and sowed clean oats; part part of it was on the hillside and quite dry; part of it was on the bottom where it was naturally sub-irrigated. When we cut the crop there were no wild oats present. Volunteer oats came up on the sub-irrigated area and matured a crop of wild oats the same fall.

Mr. C. F. Stork: I can substantiate that on my farm, and they come up spontaneously all over the country. People that sow pure white seed get in return black oats, and I know it is so all over the country.

Mr. P. W. Bradford: Mr. Chairman, fourteen years ago I plowed a little patch of land and seeded it to oats. Part of this land was subject to overflow from the Missouri river, and it ran up where it was two or three feet of high water and killed the crop wherever it overflowed, and there was a little flooding around some of those oats; well these oats matured, but they weren't harvested and I have never paid any attention to them since that time. Volunteer oats have grown and matured seed on this ground every year since and there is no evidence of a change to the wild form yet.

Mr. Daniel Payne: Mr. Chairman, I should like to ask Mr. Stork what he fed his horses when he was plowing his ground. If wild oats were present in the grain he fed his horses at the time the land was being prepared and seeded, the ground would become seeded in this way as many wild oats pass through the horses undigested. I never had a wild oat on my farm while I sowed my crops by hand but as soon as I got a binder and cut my neighbor's oats, I noticed some on my farm, as they stuck to the canvass and were dropped in my fields later.

This is a question of vast importance throughout the Northwest. There seems to be as wide a difference of opinion amongst those taking part in the foregoing discussion.

It is believed by many leading botanists in Europe as well as

in this country that, the characters in the wild and tame oats are so fixed that degeneration or reversion from one type to the other is impossible. Contrary to this, results of experiments are reported which indicate that such changes do occur. Further experiments will be necessary to bring out conclusive evidence on this point.

IRRIGATION.

By W. M. Oliver of Dillon.

Irrigation is one of the oldest arts of man, and under this system of agriculture the first history of man began, and under a system of artificial irrigation civilization was born. We find everywhere throughout the habitable globe the first agriculture began in arid lands and the first dense population was found in regions where the heavens refused sufficient moisture for crops to grow—as for example, in Egypt—and no doubt man first conceived the idea of irrigation from the overflow of the Nile. This is the country in which irrigation was extensively practiced 2000 years before Christ and where great systems of canals and artificial lakes were formed for this purpose.

Extensive works intended for irrigation of large districts existed in times of remote antiquity. In India, China and Persia and other parts of the east, in such of these countries as have not lost their ancient prosperity, such works still exist and are being used today. In many parts of the world the necessity for irrigation was so strongly felt that the agriculture of comparatively rude tribes depended upon it, for instance, the desert regions of Mexico and Peru developed this ancient mode of agriculture. Irrigation prevails in all the southern portion of Europe and was extensively practiced by the Romans, who introduced it into England where it is today to a limited extent practiced upon grass land. We find that all the great plains and valleys of the southern part of France and Spain are almost entirely subject to a systematic system of irrigation.

We find that irrigation very greatly increases the fertility of the soil. Especially is this true of India, where some lands have been devoted to agriculture for thousands of years. It is said that all soils of a volcanic formation are inexhaustible with a proper system of irrigation. The extent of irrigated land in one

valley of Italy alone amounts to over 1,600,000 acres—that of the river Po.

The largest arid region of the United States extends from the Rio Grand river along the base of the Rocky Mountains to the British Possessions, a distance of 1000 miles with an estimated area of nearly 1,300,000 square miles and estimated as capable of supporting a population of 9,000,000 people. Great attention has been paid to irrigation in all this vast intermountain region. It is said that on perhaps one-half of the North American continent the rainfall is too small to support those forms of vegetation upon which man depends for his food. This great area, marked by scanty plant life, lies in a general north and south direction, beginning in high latitudes where the low temperature forbids the growth of many species of plant life, and continued through the United States and into Mexico until cut off by the belt of tropical rains. The eastern border of this vast region of drought is usually taken for convenience as coinciding with the 100 meridian and taking this as the eastern limit, it extends to the mountain ranges bordering on the Pacific Ocean. This vast country contains great deposits of mineral wealth and embraces agricultural lands as rich as any on the globe.

Since the supply of water is too small for the needs of man, we are here confronted with the question as to how to make this region productive. We find the only means is by irrigation. Then it behooves us to study well the economical as well as the practical distribution of our water supply. The principle means for conveying the water of the streams of this vast area is by ditches and canals with innumerable laterals. Of late years extensive work is being done in the line of reservoirs, copied after the ancient irrigation tanks of Asia. It is estimated that there has been over \$50,000,000 expended by incorporated companies in the construction of irrigation canals in the United States. Over \$13,000,000 have been spent in irrigation works in California; \$15,000,000 in Colorado in similar works, with over 4,000 miles of ditches supplying over 2,000,000 acres of rich agricultural land. Wyoming has spent several millions and has over 2500 canals. Kansas has over one million dollars invested in irrigation enterprises. New Mexico has two canals which cost over a million dollars and has also a number of reservoirs; Arizona expended over three million dollars in the 80's, \$2,500,000

in the Gila valley alone. In India the enormous sum of \$360,000,000 has been expended in irrigation works, one single canal system, that of the Great Ganges canal, cost \$15,000,000 and several others have cost over \$10,000,000 apiece. Utah has one canal which cost over \$2,000,000 and will irrigate about 200,000 acres. Idaho has spent in the past ten years several millions in the construction of canals, as much as \$3,000,000 having been spent in the Snake River valley in 1890 to 1895; Oregon has in the past few years done much towards the reclaiming of her arid regions; Montana until about 1880 paid but little attention to irrigation except in those valleys adjacent to mining camps, and it must be remembered that the population of Montana in 1880 was only about 40,000, and but little could be expected before this time. About 1882 a number of large irrigation enterprises were inaugurated, and in fact about this time a very active interest was taken in irrigation all over the state. There is estimated to be fully 2,000,000 acres covered or partially irrigated by ditches in Montana. But much remains to be done and while we are not suffering as are some other states from overbuilding of ditches, yet there is a great deal to be accomplished which is natural and certain to follow the great work of irrigation within our state. The spread of knowledge upon this great and vital subject should be encouraged in every possible way; interchange of opinions will, I hope, come about more rapidly under the influence of the Farmers' and Stockgrowers' Institutes of our state. Montana is most fortunate in being one of the best watered states of all this vast arid region. This is true both as to the amount and the distribution of the water throughout the state.

No general fact in relation to the use of water can be properly stated of Montana as within her vast borders are included the greatest variations in elevation, topography and soil. Narrow valleys, which to an eastern farmer would appear useless, are made under irrigation to yield wonderful results, Montana is suffering from the lack of farmers; this is greatly owing to the fact that the lands easily reclaimed are held in large bodies thereby retarding emigration and settlement. There are strong indications that the state is entering on a new and different era; the large holders of irrigable lands are beginning to realize that they are too valuable to lie idle and are being offered in small tracts

to settlers. The future extension of irrigation of any importance in this state must come from the diversion of the water of our large rivers and this can only be accompanied through government or state aid or the investment of large sums in corporate enterprises; another aid would be to store in reservoirs the water of our streams which go to waste for the greater part of the year. The United States government has done much to encourage irrigation works and for several years congress has had a joint special committee on irrigation of arid lands.

Beaverhead county was among the first counties of the state that practiced irrigation. The first farming in our county was done on what is now known as the Thorpe ranch; the ground was broken with a spade; about an acre was planted in potatoes from which was realized about \$700. This was in the season of 1864. The Selway Brothers were the first to use a plow, which was in the year 1865. Their crop consisted of potatoes, wheat and oats, and it is useless to say that the price realized must have been entirely satisfactory for they have remained here, making this their permanent home.

The county shows wonderful development in the past twenty-five years; at that time there was less than 50,000 bushels of grain grown in the county, and the people depended entirely upon wild hay. Today there is raised fully 100 times as much wild hay and thousands of tons of tame hay and over 500,000 bushels of oats alone. This county has the distinction of having among its citizens one who has reclaimed a vast tract of arid land and whose crop last year came near the 100,000 bushel mark; this being nearly twice the amount of grain raised in the entire county twenty years ago. These wonderful results have been attained through irrigation. The farmers in the early days may not have known much about irrigation but must be congratulated upon having the most essential factor to successful irrigation, **an abundance of water.**

RESERVOIRS.

By Geo. R. Metlen, Dillon, Montana.

Perhaps at the present time there is no subject that attracts the attention of the farmer and irrigator so much as the question of reservoirs and storage of water. It is a comparatively new departure, and so far is in the experimental stage. Not that there have not been reservoirs in existence for years, but the matter of storing water for irrigation has only been brought before the public in recent years. In California there are some large storage reservoirs which were built in the days of placer mining that are now turned to account for irrigation.

In Montana, and particularly in Beaverhead County, storage reservoirs are a very recent innovation, but to-day, I believe, there is more water stored in this county for irrigation than in any other county in the state, Mr. J. E. Morse, of this city, being the pioneer in first bringing to successful operation an irrigation storage plant. He has, unaided and alone, built and put in successful operation seven reservoirs of a total storage area at this time of 2,900 acre feet, and each season is augmenting this acreage by adding height to his dams. These dams are situated at the headwaters of the Birch Creek, a tributary of the Big Hole river, and are situated on the north water shed of the high spur of mountains between the Big Hole and the Grasshopper. They are at an average elevation of 9,000 feet above sea level. They all cover lake beds, and the storage obtained by damming the outlets of these lakes is all maximum, a very desirable feature in any reservoiring proposition.

The very high altitude at which these reservoirs are situated makes them very late storage, the snow beginning to melt and the ice to break up about the first of June, which makes the stored waters available for the last irrigations in July and August. These dams are all earth and rock, riprapped with from two to four feet of heavy rock on the upstream face and made water tight by a central core of earth and clay. They cost on an average \$2,500.00 each. The greatest height is at what is known as the Pear Lake dam. This dam is 19 feet in height from the outlet pipe to the top of the spillway. The other dams range in height from eight to fifteen feet.

The only other storage reservoirs in operation for irrigation or building at the present time are situated at the head of Rattle-

Snake creek, and are owned by the Rattlesnake Reservoir Company and James Kirkpatrick. These, like the Morse plant, are all lake propositions. The Kirkpatrick reservoirs consist of three small dams upon which Mr. Kirkpatrick has labored for several years, but as yet he has not completed them sufficiently to use the stored waters to any extent.

The dam and reservoir owned by the Rattlesnake Reservoir Co. is a new dam just completed last season, and the coming season will be its initial step toward furnishing water to the owners. This reservoir covers Lake Esler, a beautiful mountain lake having an area of 80 acres on the 15 foot contour and 120 acres upon the 20 foot contour. This reservoir is an example of what can be accomplished in the way of reservoiring by poor men whose principal stock and resources are plenty of pluck and a willingness to work.

This reservoir site was surveyed and papers filed with the Secretary of the Interior by Gus. Keith, John Spar and James Melvin in the fall of 1901. Before the following spring, Keith and Sparr disposed of their interests to Messrs. Banning and Stahl, and these three, Melvin, Banning and Stahl, undertook and carried out the erection of a reservoir dam 12 feet in height and 300 feet in length on the top. These men were all poor men with hardly credit or money enough to get the necessary provisions and tools, but they undertook the construction of the dam during the summer of 1902 and completed the same, late in the fall. They were, however, unfortunate in that they were unable to build the proper spill-way, and the dam was partly destroyed in the spring of 1903, but these plucky sons of toil went to work and repaired the damage in time to get their dam full of water for use during the season of 1903. During the season of 1903 the original owners sold out to the Rattlesnake Reservoir Company, which is composed of all the water rights on the Rattlesnake creek, strengthened the dam and raised it to a height of 20 feet, and expects to get at least 17 feet of storage during the coming season.

This is proof of what can be done where there is a will and plenty of backbone. Here we see three men, whose total assets were a span of cayuse horses each, a sleigh, a scraper and plenty of nerve, undertaking a task no greater than the farmers all over the county are asking and clamoring for the government to take hold of, and, what is more, they made it win.

I have given a general summary of the reservoirs in operation or building in this county, and it might be well to look somewhat to what is possible in this line. Generally speaking, there are three things essential to make a reservoiring proposition: First, a feasible reservoir site, sufficient water to fill it and land adjacent, upon which it can be used. The first is by all means the most difficult to obtain, and after examining a great many propositions I have found very few that will pay for the building of a dam. The most desirable of all reservoir sites is a lake bed, first, for the reason there is no doubt as to the bottom holding water; second, and perhaps just as important a reason, the storage is all maximum storage, and for every foot of dam you have one foot of stored water. The outlet of a lake is generally very close to bed rock and presents a good location for a dam, where contact with solid formation can be had at a minimum expense.

After the lake come valleys. These are for the most part used for farming purposes and become expensive at the outset for right-of-ways, and the storage is limited to one-half the height of the dam; that is, a valley in which a reservoir is built will have but one-half the storage capacity of a lake of equal area and height of dam, and at the same time, the uncertain and unknown element of percolation through the bottom of your reservoir is to be met. The bed rock, as a general thing, is beyond reach and an earth dam is the only means at the disposal of the builder.

Canyons come next, and to the layman there is seemingly a vast field for reservoiring in our mountains, but here is the greatest mistake of all. The canyon, as a general, and I might say universal case, is very steep and narrow, the question of a dam site and bed rock is such as to give but little thought, but it is next to impossible to get a site that will store enough water to pay for even the cheapest kind of a dam, and they are not worthy of consideration.

There are, however, in Beaverhead county and adjacent thereto propositions that should and will be looked into and taken up and carried to a successful completion in the future. On the head water of the Big Hole there are numerous lakes that will store a vast acreage of water, but unfortunately the land adjacent is sufficiently well watered so that it will be a long time before these propositions are looked in to.

The only other available reservoir sites to my knowledge of any consequence are in the Sheep Creek, Sage Creek and the

Centennial Valley. These are all valley propositions and give but one-half the storage that is possible on a lake surface.

The Sage Creek proposition is a very simple and comparatively cheap undertaking, 25 feet being the limit for the height of the dam and the length being not over four hundred feet, but unfortunately the formation is such that a foundation is next to impossible, the depth of the gravel wash being very great and the question of a spill-way being the most strenuous of all, as the stream feeding this site is very erratic and treacherous, the flow running from two to three cubic feet per second to 500 to 700 in a short space of time. But this site will be attended to in the future as there is land available, and good land too, not a mile away from the dam site. The probable storage area of this place is about 3,200 acre feet, and figuring that the stored water will have an efficiency of 75 per cent, it will irrigate 2,400 acres, one irrigation one foot deep, or three irrigations of four inches each.

The Sheep Creek site is an ideal site as far as a dam is concerned but the storage area is quite small. A high dam, however, can be built at this point very cheaply and all the questions of foundations and spill-ways are very simple.

These two propositions are not for large corporations, neither should they be held up for the government reservoir aid, but they are propositions for the men who own land adjacent thereto to take hold of and build a little at a time, as they are able.

The only other reservoir site of any consequence left is the Centennial Valley proposition. There are two propositions here, the first being what is known as the Lima Irrigating Co.'s dam, which you, or a great many of you, are familiar with. This dam was first brought to public notice in 1890 when a dam was started and pushed to partial completion in 1891, the panic of 1892 putting a stop to work and the dam was destroyed by the timorous inhabitants of the valley below, who feared a repetition of the Johnstown disaster. Since the destruction of the dam the proposition has remained just as the water left it, after washing it out with the aid of the ground-sluicing method, until 1901 when Messrs. Lindsey, Stuart and Williams, of Butte, bought up what existing rights there were to the old dam and applied for a right-of-way for the reservoir from the government. They have as yet done nothing further than this and are holding it at present under the act, governing reservoirs, railroad and other right-of-

ways. They, however, have a fee simple to the canyon leading up to and covering the dam site, having purchased the same from H. J. Thompson who secured it by means of land scrip. This is the most important of all reservoir sites adjacent to Beaverhead County, and the farmers and irrigators who own water rights fed from the drainage of this reservoir can not afford to let this vast storage area go into the hands of the government or to a private corporation. The total acreage of this site is 2,876 acres, which, with a forty foot dam, can be covered to an average depth of 20 feet, and the storage capacity is only limited by the height of the dam, the probable limit being 100 feet. However, if the dam is carried to a height above forty feet, right-of-ways will have to be bought, as the water would cover ranches above the limits of the right-of-way, as now applied for. This, on the face of it, looks like a very great undertaking, but if the decreed water rights in the Beaverhead and Red Rock rivers from Dillon to the dam will each put up fifty cents for each inch of water decreed by the courts to them they will have a fund of \$35,000, there being over 70,000 inches of water decreed. This, if judiciously used, will erect and equip this dam and the value when completed can not be estimated. As 40,000 yards of filling will erect the dam at 25c it means \$10,000 for the dam leaving \$25,000 for gates, etc.

This reservoir, lying as it does at an elevation of 6,500 feet, and surrounded by one of the highest water sheds in the state, can always be depended upon to give the total available storage. The enormous storage can not be realized, but to illustrate I will give you a few figures upon the possibility of this storage. Taking the area on the forty foot contour, which is in round numbers 2,800 acres, and the storage at 50 per cent of this, with a forty foot dam, we have 56,000 acre feet. After the first day of July on an average the Red Rock river will not flow over 2,500 to 3,000 inches of water at the dam site. If this flow be augmented from the storage by a flow of 5,000 inches additional it will take 226 days of 24 hours each to empty this stored water, that is seven and one-half months, so it will be very easy to get a constant flow of 10,000 inches during the irrigating season and have a margin of one-half month to go on.

This is not a proposition for the government to take charge of as there are too many conflicting and existing rights and the available unreclaimed land is so small that there is no basis upon

which this proposition can be even considered under the national irrigation law. The sooner the water users of the Red Rock and Beaverhead get over the idea that national aid will be given to augmented rights, the sooner will this dam be built.

Another reason why the rights on these streams can not afford to let this dam be constructed by a corporation other than the water owners themselves, is that if this dam is constructed by a corporation, either private or government—subsidized, this corporation will immediately cut every owner of a water-right down to the amount decreed and take what is left of all surpluses for their own benefit. This will be the case particularly with a private corporation who will try to make the scheme pay interest, and all the surplus water they can obtain outside of the storage will be eagerly appropriated.

There is one other class of reservoirs that are within the reach of all who have the applicable conditions, which are small streams of water which are too small for effective irrigation but constant in quantity. There are such streams of water in the shape of springs on a great many ranches. These streams are too small to pay to keep a man irrigating and in most cases are let go on pasture land or run to waste without much care being taken of them. It is possible, also, in most all cases, to find a draw or ravine that is fit for the construction of a small reservoir and that will hold the flow of the small stream for 12 to 24 hours at least. By this means the water can be stored at night if the stream is one-half an irrigating head capacity, say from 20 to 40 inches, and an effective head is obtained during the day that can be conveniently handled and keep the irrigator busy and do twice the work almost, that would be possible with the small head running constantly.

Mr. J. E. Morse has a reservoir of this kind upon his Mantle ranch property where a spring of 40 inches capacity is available. The dam was built in a small ravine and the storage area is about an acre in extent. The dam is 10 feet in height, giving an approximate storage of 5 acre feet, this, in addition to the constant flow of the spring, gives a very effective irrigating head which can be used during the day time. This plant cost about \$300.00 and proved highly efficient.

In conclusion I will say that, generally speaking, the government aid in reservoiring propositions will be turned down, for the reason that the irrigation problem in lands upon which their

entire value rests upon the water rights belonging, is so great that it will be detrimental to the existing rights in excess of what it will be able to benefit to new reclamation.

In a section of the country where the streams are large and run in deep channels and the contour of the country is such that the average community is unable to dig ditches or build dams, government aid can be called in to profit, but on the smaller propositions in a developed country they will hesitate to enter.

I might mention here that in my summary of the Centennial Valley proposition I stated that there were two propositions. I have described the one, the other being the Red Rock Lakes. These lakes are several thousand acres in extent and will pay for a limited hight dam, say from four to ten feet in height. The dam would have, of necessity, to be an earth dam, as the foundation in earth is of unknown depth the dam would be quite long and for this reason would be quite expensive. Some shore rights would have to be purchased before the water was raised, but the storage would be all maximum storage and I dare say greater than the dam lower down the valley, with a dam from four to six feet in height.

These propositions must sooner or later be made available and it behooves the water rights on the Beaverhead river to get to the lead and start the ball rolling for their own protection.

POSSIBILITIES OF SUGAR BEET INDUSTRY.

By W. M. Wooldridge.

A representative of the Utah Sugar Company who has just paid a visit to Northern Montana for the purpose of looking over this section with a view to the establishment of that industry in this state and possibly the investment of capital, said:

The first factory erected in Utah was the Lehi factory built about 12 years ago. Like all new undertakings, it was beset with many discouragements in its earlier days, the principal one being its inability to secure a sufficiency of beets, causing short runs and greatly increased cost of production.

The Lehi factory was built by capital furnished by the farmers and business men of Utah. After construction the value of that stock did not reach par for several years, some of it selling as low as 65 cents on the dollar, yet, with the better understanding of

the best conditions governing the production of beets, and more being produced, this factory was finally made a great financial success, and up to date has paid in dividends \$1,000 for every \$100 originally invested, and as a direct result of its phenomenal success, seven other factories have been established, five being in Utah, one in Oregon and one in Colorado.

A new feature recently established in connection with the parent sugar plant at Lehi has been the construction of two auxiliary plants. These are mere crushing and juice extracting plants, the refining being completed at the central plant, one of these auxiliary plants being 17 miles distant, the other 16. The juice is forced by hydraulic pressure through pipe line to the central factory and there the process of sugar manufacture is completed. This juice must reach the refining vats within two hours of extraction from the beets or it will sour and spoil.

The following tables will prove interesting:

Locatoion of Factory	Daily Capacity	Tons beets Used Yearly	Paid farmers yearly	Tons sugar made
Lehi, Utah	1,000	.....	\$442,000	.....
Garland, Utah	1,000	*40,000	.....	9,000,000 lbs.
Ogden, Utah	500			
Logan, Utah	500	**	\$400,000	.....
La Grande, Ore.	500			
Idaho Falls, Id.	1,000		\$152,000	corner stone this factory laid in April last.
Sugar City, Idaho	1,000	***	.....	Be ready 1904 crop.
Loveland, Colo	1,000			
		Used 2nd year	\$300,000	5,500 acres planted.
		Used 3rd year	500,000	9,000 acres planted.
		Used 1st year	671,000	10,000 acres planted.

*** New building.

* Only built in 1903.

** Amalgamated.

Items:

Six (6) factories within radius 50 miles Loveland paid \$2,000.-000 to farmers during past year.

John Jones has grown 4 acres beets yearly for past 13 years and realized \$100 per acre yearly.

Isaac Gough grew 50 acres beets; secured 6,000 tons, which realized \$120 per acre.

Idaho Falls factory paid \$15,000 to children alone during past year for services in thinning beets during school vacation.

During 1901, 100 acres alfalfa land seeded to beets yielded revenue \$8,000; same land in 1902 yielded revenue \$9,963, and in 1903, \$10,000, produced at a cost of \$24 per acre.

In Cache Valley 4,000 acres in 1900 yielded 18,000 tons; in 1903, 40,000 tons, giving net increase of over 100 per cent in 1903.

Beet seed sold to Utah farmers amount to \$75,000 yearly, all imported.

Beet pulp sells to dairy and stockmen at 35 cents per ton, and has actual feeding value of \$1.50 per ton. Keeps indefinitely, freezing or summer heat not affecting its feeding value, has been fed after five years with no apparent deterioration or ill effects to stock fed.

Any good potato or alfalfa land is suitable for beet culture. Nearly all western lands being very deficient in humus, it is found that this is cheaply overcome by seeding land to alfalfa, then after cutting one or two crops, an alfalfa crop is plowed under during mid-summer and permitted to rot; this is done four inches deep; the following spring land is plowed to two or three inches deeper; each succeeding year it is plowed deeper until depth of 12 inches is reached.

Freezing does not injure gathered beets if they are permitted to thaw out.

Average yield for Utah is about 12 tons per acre, sugar content about 235 pounds per ton.

Beets containing less than 14 per cent sugar in juice is seldom used. The price paid farmers depending upon sugar content, basis being \$4.25 for 14 per cent beets, with an additional 25 cents for every one per cent increase.

Coal and lime rock suitable are principal requisite outside of beets, 500 tons coal being used daily to every 1,000 tons beets manufactured, the amount of lime rock about two-thirds of this. The rock must be burnt at factory as gases are used in sugar manufacturing.

For successful operation of factory 5,000 acres of beets must be planted, preferably on irrigated land, and 50,000 acres irrigated land must be under cultivation in district to secure profitable rotation of crops.

United States imports annually \$100,000,000 of sugar; the increase in construction of sugar factories merely keeps pace with increased consumption, then there is hardly any possibility of over production.

Beets can be transported 100 miles to factory, depending largely upon freight rates obtained.

Immense quantities of water are necessary for operating the factory. This must be reasonably pure and free from alkali.

The development of sugar culture in Utah is a direct result of a bounty of two cents per pound for a period of five years.

Total output Utah factories in refined sugar for 1903 was 50,000,000 pounds.

A land rental of \$7 per acre is often paid for use of land for beets.

Dry, sunshiny weather is absolutely necessary for successful ripening of beets.

Land contiguous to sugar factory was worth \$30 per acre when factory was constructed; now \$50.

Increased value of taxable property in Idaho Falls district amounted to \$21,657,200 in 1903.

Increased valuation of taxable property in Fremont and Bingham counties, Utah, has amounted to \$43,355,200 within two years.

A 1,000 ton capacity sugar factory costs from \$1,000,000 to \$1,100,000.

Larger factories are found to be cheapest in the end, as the cost of manufacture increases with smaller factories.

Extensive farming, dairying and stock fattening follow the erection and operation of sugar factories as natural adjuncts.

Senator Smoot, of Utah, when at the Irrigation Congress at Ogden, said that the factories had actually compelled their farmers to do better farming, and in this respect alone the investors felt amply repaid for outlay.

Now, so much for Utah. How about Montana? Through a series of nearly 12 years considerable attention has been given to the culture of sugar beets in Montana. The results have been more than encouraging, there being no difficulty experienced in securing beets averaging from 17 per cent to 22 per cent sugar. The beets grown on the Great Northern Demonstrative Garden at Hinsdale two years ago assaying 22.5 per cent sugar in juice, with a purity of 79 per cent.

Investors would prefer irrigated sections, where the land was well occupied by an industrious people. For instance, such locations as the Western end of Milk River Valley in vicinity of Chinook, the Eastern end of the same valley in vicinity of Hinsdale, are ideal locations, and would afford each station along entire valley to profit by erection of factory. The Gallatin, in vicinity of Bozeman, the Yellowstone, in vicinity of Billings, the Bitter Root, in vicinity of Stevensville, are all ideal locations, with

sufficient area of irrigated land near and fuel and lime; the land is occupied. Much of this land would be divided and farms would become smaller and much more profitable.

It was felt by last session of our legislature that some encouragement should be held out to establish this industry in Montana, and a bill passed both houses, but was vetoed. This prayed for a bounty of one cent per pound.

Before a success could be made of any factory, a much denser population is necessary in even those portions of Montana now thought to be thickly settled. Forty to 80 acre farms would prove ample and more profitable than much larger ones under present conditions. Our soil and climate is peculiarly adapted to this industry, and Montanans should awaken to this fact, and co-operate to secure establishment of it here.

Horticulture.

PRINCIPLES OF ORCHARD PRUNING.

By R. W. Fisher, Horticulturist, Montana Agric. Exp. Station.

Last year at the meeting of this Society in Stevensville I had an opportunity of saying a few words about the pruning of orchard trees, and it was with some reluctance that I accepted Mr. Heideman's invitation to speak on this topic again. However, it strikes me as being a very important subject for Montana orchardists and after considering the question for some time I accepted, although I may not be able to throw any more light on the question of pruning than was brought out in the papers and discussions of last year.

It is often asked, "Why is it necessary to prune at all?" Some one says, "My orchard trees grow well, bear fruit; and I can see no necessity of so much labor in cutting out limbs every year." For an answer we have but to go to Nature, and there observe the methods of growth and the struggle for existence between plants and parts of plants. As we see plants in their natural habitat, pruning themselves with a most relentless vigor we are likely to come to the conclusion that if Nature prunes man also should prune if he desires to get the best results from his orchard. Pruning is not unnatural but quite the reverse. The forest floor covered with dead twigs is a good illustration of Nature's pruning. The long slender bole of the stately pine is attained only after years and years of the severest kind of pruning. Or again we can observe an old orchard that has been neglected in its early or formative period, and there we see many dead or dying branches, showing that the struggle for existence is as keen between different parts of a plant as between different plants, and wherever this struggle for existence takes place pruning is done.

Nature prunes sufficiently for her purpose but it is usually a slow process and can always be assisted materially by man; and pruning by Nature is for different results than that by man. The aim of all plants is to produce seeds or the capacity of repro-

ducing themselves, and all pruning by Nature is to that end. The one object man has in orchard pruning is the production of more and better fruit than could otherwise be produced, regardless of seeds, and therein lies the difference between the two methods. Especially in the high altitudes and localities of short-growing seasons, followed by long severe winters—regions not particularly adapted to fruit production—we find this characteristic of seed production, and we see trees producing full crops of fruit or seed at a very early age. In fact far too early, for it is at this period of their lives when the trees should be growing and making a good strong foundation for future usefulness. This premature fruiting characteristic is accountable for so many comparatively dwarfed trees in the state, as a tree cannot produce fruit and wood growth at the same time. Unless one is held in check the other will suffer.

You may ask how to prevent this seemingly natural character of the tree toward early fruiting. That is one of the offices of pruning, either by severe pruning of the top in winter or by pinching off blossoms. It is an established fact that pruning done at a time when the tree is in a dormant state will produce wood growth rather than fruit, and this should be the aim and object of every fruit grower in Montana during the early part of his orchard's life. To produce a large healthy tree, for only then can he expect to get a maximum amount of fruit from a tree during its lifetime. We are bothered very little in Montana with excessive wood growth, under normal conditions, as is the case in eastern states and in orchards west of the Cascade mountains in Washington and Oregon, where the atmosphere is laden with moisture and the growing season very long. It naturally follows that we have an entirely different object in pruning than people in such places. They prune for fruit as a primary object, while we should prune for wood as a primary object and the fruit will then come in an abundance. Even in our own state the method and amount of pruning depends largely upon the vigor of the trees and local environments, and it is impossible to lay down any fixed rule as to how the pruning should be done or how much cut out. In the Bitter Root, Flathead and Yellowstone valleys and other natural fruit producing sections, the pruning is of necessity different than in localities where the tree growth is not the same. We cannot prune in the same manner in the Gallatin valley and get the same results

as they do in the Bitter Root valley, because our trees do not make as thrifty a growth. The same is true in other parts of the state and every person has to figure out his own system. And then again every tree should have an individuality to the operator, each receiving its own peculiar treatment. Who would think of pruning in the same manner the Hibernial or Longfield as he would the upright growing Duchess or Yellow Transparent? Yet there are those who call themselves professional pruners who treat every tree and every orchard in the same manner. Trimming it up to some fantastic shape. The man with one system of pruning is the man who should be kept out of your orchard for he will do far more damage than good.

The best pruning is that which is directive rather than corrective. That is pruning that will force a tree to grow to a certain defined shape and produce certain results, rather than to let it grow haphazard for several years and then have to cut it down to the desired shape. To do this kind of pruning the operator must start in early as the foundation of the tree's shape is formed in the first few years of its growth, and at this time it is much easier to direct its growth than it is later to cut it down into the right shape. Good intelligent care in pruning for three or four years is almost all that is necessary in many of our orchards. The later pruning consisting mainly in obtaining new wood for fruit buds and trimming out unruly and dead limbs as they may appear.

The manner in which fruit buds are borne upon a tree should be known, as different kinds of fruits demand different treatment during their fruit-bearing time on account of the different way in which fruit buds are formed. Apples, pears, cherries and many varieties of plums are borne on short stubby branches, devolved on wood at least two years old, and continue fruitful for a period determined by the variety and local environment. The apple and pear fruit buds are terminal and therefore the fruit spurs are zigzag in shape, the but that continues the growth of the spur being lateral. These fruit spurs will produce a superior quality of fruit for only three or four years after which time they should be cut out, and in well former trees,—trees that need no corrective pruning—the trimming out of the fruit spurs and inducing new ones to grow is practically all that is necessary. Pruning of wood as a method of thinning the fruit is not generally to be advised, as it only thins the fruiting branches and not

the fruit on the branches. The fruit buds on plums and cherries are lateral, on short spurs, or are terminal with some other leaf or buds that will continue the growth of the spur, and are fruitful for an indefinite period. The pruning, that is necessary for this class of fruits consists mainly in cutting out dead limbs or limbs and twigs that rub or run crossways of the tree, and to keep the top from becoming too thick with limbs, as in that event the fruit will not ripen or color uniformly.

However this ideal system of pruning is not always to be found, as we quite often have trees that require renovating or working over, and this is a thing that requires considerable skill and knowledge of tree growth to do successfully. Where there is much of the top to be changed it will not do to cut it all out in one year, as we are very likely to get more wood back in the shape of water sprouts than was cut out, but it is imperative that the limbs to be cut out be determined at once and be gotten rid of as soon as the tree will stand it; but as stated before it will not do to give the top too much of a shock the first year.

Our sunlight in Montana is very bright and usually colors the fruit beautifully, nevertheless I have seen bearing trees in which the tops were so dense that no rays of direct sunshine could possibly strike the fruit. Such trees should not be. The fruit does not ripen uniformly nor is it as highly colored as it should be and goes on to the market as second or third grade fruit. A brush pile in the air is as useless as a brush pile by the wayside and should be gotten rid of.

My opinion in a few words of how pruning should be done in Montana is about like this. Start in at transplanting time and prune severely every winter or early spring during the first four or five years of the tree's life, thus establishing a good strong foundation for the tree's fruiting period. The later pruning will consist mainly in the maintenance of new wood for fruit buds and the cutting out of limbs that cross or rub each other.

DISCUSSION AT GREAT FALLS.

Mr. O. H. Barnhill: Mr. President, I would like to ask Professor Fisher if there is anything in cutting back the top in order to grow a strong body. Some complain of the trees getting top-heavy and keep pruning back the top in order to let the body grow.

Professor R. W. Fisher: There certainly is if the pruning is

done at the right time in the year. If you prune when the tree is dormant, the tree will regain its balance before it starts to grow, and wood growth will be produced. If you prune the top when the tree is young, it will produce new wood growth, and naturally the stem will grow larger than it would if the top were allowed to grow without any pruning, and many small branches be allowed in the tree. If you prune in summer, or when the tree is in a very active state, you will produce wood growth in the shape of water sprouts, and in that event there would be no addition to the trunk or no wood growth will be produced, but instead fruit buds.

Mr. Fred. Whiteside: Mr. Chairman, there is a question that comes to my mind that is perhaps, strictly speaking, not a matter of pruning; but, in the gathering of cherries, some people follow the practice of cutting the cherries from the tree and others of pulling them. It has been held by some that to pull the cherries off, skins down the limb or fruit spur so that the tree will not bear as well. I would like to ask the Professor his ideas of that.

Prof. R. W. Fisher: Some varieties of cherries you almost have to cut them from the trees to get them, and many others come from the stem so easily that it is not necessary at all. Many of our cherries that are grown in Montana of the sour varieties are very hard to get from the tree, and probably the cutting of the cherries from the tree with scissors would be better than pulling them off where they often take a piece of the bark with them.

Mr. O. H. Barnhill: What I wanted to know more particularly was whether the pulling of the stem from the tree would prevent the tree from fruiting thereafter, or have a tendency to?

Prof. R. W. Fisher: I don't think it would, unless the buds were injured by pulling the fruit off.

Chairman W. B. Harlan: In some of my varieties, if you pull the clusters of cherries off of the stem, as you have to for the market, you also pull the cluster of buds preparing for the next year's fruit. In that case you would ruin the next year's crop, and with such varieties I find I have to cut them.

Mr. O. H. Barnhill: Mr. President, my observation and experience has been that it is very important to have the central stem in an apple tree, because otherwise the limbs are very much

in danger of splitting down, but it is very difficult to get a well defined central stem or leader and keep the head; and some think this the wrong system to prune apple trees. Mr. Whiteside, I believe, has cut out the central stem in many of his trees, and I would like to hear that question discussed, if it is possible to grow a central stem and if it is best, how to do it.

Mr. Daniel E. Bandmann: Mr. Chairman, that is the very question I would like to have brought up, as to the pruning of the leader. Now, I read considerable on that question, and I began to prune my leader, for the reason that it opens the tree, it gives the tree more light and more air. It endangers the surrounding branches somewhat in the matter of breaking off, especially when they are heavily weighed with fruit. The very thing that happened with several of my Duchess trees—couldn't help myself—they were all fine, magnificent apples, and I hated to cut them off. The way I prevented that was to go around the early part of the ripening of the apples and pick those apples that ripened first, to alleviate the weight of the various branches, and in that manner I have saved quite a number of branches from breaking down, and I think it is a good way of picking apples, though, as a rule, we go around and pick the whole tree clean when it is bearing fruit. But I should like to ask Mr. Fisher if he proposes the pruning of the tree during the dormant time?

Prof. R. W. Fisher: Yes, sir.

Mr. Daniel E. Bandmann: Now, isn't it a fact that you can prune a tree at any time of the year, and that summer pruning is far more conducive to the health and vigor, especially to the fruit-bearing parts of the tree, than at the dormant state?

Prof. R. W. Fisher: Well, my opinion is that trees in Montana will fruit without any pruning. Most of the pruning that we need to do here, I think, is for wood production, and that is the reason I advised winter pruning.

Mr. Daniel E. Bandmann: Then you believe we should check wood production for the purpose of creating fruit production?

Prof. R. W. Fisher: No, the trees naturally fruit here without pruning.

Mr. Daniel E. Bandmann: I am sorry to differ with you. It seems to be my fate to differ with everybody,

Prof. R. W. Fisher: That has been my experience in Mon-

tana and in the states west of us, east of the Cascade mountains; in the high altitudes they will fruit and fruit prematurely.

Mr. Daniel E. Bandmann: Well, I follow the maxims of an old fruit grower, Mr. Bass. Years ago I asked Mr. Bass how soon I should pick my fruit from the trees. He said, "As late as possible; don't pick them too early"; and I have followed that maxim, and I find he is perfectly right. I heard my friend Whiteside say he picked fruit from the McIntosh two years after it was planted. I am sorry to hear him say so. I wouldn't allow a tree to bear until it is five or six years old. Of course that depends a good deal upon the location; if you are in a good deal more southerly climate, you should pick them earlier.

Prof. R. W. Fisher: I don't see where we differ.

Mr. Daniel E. Bandmann: I will tell you where we differ. The system of pruning is that you should prune the weak parts of all branches, no matter what, whether they are fruit-bearing branches or not, for the purpose of strengthening more the strong parts. That, I consider the proper system, and it doesn't matter whether you prune in winter or July. That winter pruning with me I consider mostly as early pruning, that is, pruning during the early part of the tree's life. When a tree is young, then you build a tree that has the right foundation; you don't have to do any corrective pruning. All you have to do is to trim out branches that you don't want there, or suckers that may arise, and that can be done at any time. If you were to do heavy pruning in the summer time, you would get more wood back in water sprouts than you would cut out of young trees. Is it not a fact that if you prune in summer time you get better fruit?

Prof. R. W. Fisher: That's just it. By pruning in summer time you induce fruit; by pruning when the tree is dormant you induce wood; and by excessive pruning in the summer time you produce water sprouts.

Mr. Daniel E. Bandmann: Oh, well, we cut the water-sprouts out; but you create a better apple, don't you?

Mr. O. H. Barnhill: There seems to be a great deal of difference of opinion whether it is best to prune in summer or winter. Now, I think the fact of the matter is just this: When you prune in the summer, when the tree is in leaf, when there is an active circulation of sap, that checks the circulation and is a very severe check to the tree in removing a large part of the leaves,

which are the lungs of the tree, and that shock has the effect of deadening the tree. Now we know that anything that deadens the tree induces fruitfulness, because a tree when it goes to die will bear a great deal of fruit just at that time, and this deadening process just at that time causes the formation of fruit buds, and that is why the tree is fruitful. Summer pruning, on that theory, induces fruitfulness; whereas, in the winter if you cut off the limbs when there are no leaves, the sap simply goes into the rest of the limbs of the tree, and makes them grow very much ranker and stronger than they otherwise would.

Mr. Daniel E. Bandmann: I used to prune and then used to paint the wound, and I went carefully about it and put wax on it, and I was so careful about the tree that when my friend, Mr. Harlan, came to inspect my orchard he said: "I don't think that painting is any good and I don't think it is necessary". I think he is perfectly right; it does not require any wax; it does not require any paint; and the tree does not suffer whatsoever. So long as your cambium is all right, you can take a piece of bark from the tree and strip it right from the top to the bottom, and if you only leave as much as two inches on the tree, that tree will live, and the cambium will cover the entire tree up; consequently, the wound that is caused by cutting a branch, even if it is as thick as a man's fist, will heal over.

Prof. R. W. Fisher: What would it do if you cut the limb off when the cambium wasn't active and it cracked and burst and fungi got in?

Mr. Daniel E. Bandmann: The cambium is active, my friend, and even if part of the cambium is dead the other part covers it up. You know that cambium grows with a little bit of elevation and covers that wound up inside of a year or eighteen months. You can depend on that, young man. You needn't fear anything. A wound made in a tree covers itself as long as the cambium is there, just the same as if you cut your skin, as long as you suffer the unpleasantness of leaving the skin open that skin will grow and cover itself up just the same.

Prof. R. W. Fisher: As long as the cambium is all right, it certainly will heal up, but this covering is only a protection to keep the cambium alive until it will heal over; and covering with that purpose in view is a good thing, as long as it keeps the cambium from dying.

Mr. Daniel E. Bandmann: Yes, sir, so long as you cut your wound straight so that the cambium doesn't stick out that cambium will grow over your wound and cover the opening up.

Prof. R. W. Fisher: But if you have a limb an inch and a half or two inches in diameter, it will not cover in a year and a half or two years or three years.

Mr. Daniel E. Bandmann: I beg your pardon, Professor, it will cover it over in eighteen months or less, and I leave this for you to say Mr. Chairman.

Chairman W. B. Harlan: We haven't had an opportunity yet.

Mr. Fred Whiteside: I am still waiting to hear an answer to Mr. Barnhill's question about the matter of pruning out your leader, the central leader in the tree.

Mr. O. H. Barnhill: I would just like to correct an impression Mr. Bandmann has. He misunderstood me. When I spoke of summer pruning, I did not refer to the wound, the healing over, but to the removal of a large part of the foliage being a shock to the tree. That has nothing to do with cutting off the limb and leaving the wound uncovered. But I will say that I have seen trees where the wound was left uncovered, and the sap would run out and discolor. It would be similar where you cut off a grape vine early in the season, and fungus disease gets in there and it begins to rot. That is true, and I think anything like a large wound should be covered by all means.

Chairman W. B. Harlan: I do not think there is any disputing the fact that summer pruning tends to fruitfulness, but I have yet to have an experience of a man growing fruit in Montana who wants to encourage more fruitfulness in his trees. I haven't found the man yet. Our great trouble is the too great fruitfulness of the trees, and for that reason summer pruning would not be advisable if it has that effect.

Mr. Whiteside inquired about cutting out the center stem, or pruning up the tree to grow to the central stem. It depends upon the variety whether it is possible. I think he would find it almost impossible to get a well developed shape from a Wealthy apple tree, and much the same with the Duchess, while some grow that way naturally, with a central stem and branches.

Mr. O. H. Barnhill: Is it best to have the central stem if you can?

Chairman W. B. Harlan: I would much rather have it. The Wealthy is subject to growing in forks and crotches and breaking down, and so is the Duchess, while the Longfield grows the other way, with limbs going out at right angles and dropping, and they never split down. But nature has made it impossible for us to frame some trees in the shape we would like them.

Mr. T. A. McClain: I rather hoped that I could be left out on this tree pruning proposition, as I must confess I don't know very much about it. Now, I have listened to the arguments for a number of years, pro and con, on tree pruning, and I am like Brother Bandmann; if you followed up all the rules laid down, perhaps you might get around a portion of them, but the majority of trees would go unpruned. Now, I have no fixed rule for pruning a tree. I attempt to prune every tree according to its individuality. Some trees might require an entirely different process of pruning from others standing beside them and of the same variety. Now, for instance, we have two Yellow Transparents, both upright growing trees; one of those trees might have a close bushy head, and it might have to be thinned out to let in the sunshine; while the other tree, standing by itself, might have drooping limbs, which you might want straightened up and cut out. Now, I believe this: that if we depend upon one another for instructions as to how to prune trees, I don't believe we will ever accomplish very much; but we must get out in our orchard, study our orchard, study the habits of the growth of the tree, and I believe that we will come out of that orchard with ripe knowledge to help us along. I have used paint and I have used wax to cover the wound, but I find one thing the best is nature. Cut off your limbs and allow nature to do the rest. Now, I believe in not attempting to prune too early if you can help it, but as we have a great many trees to go over it would be an impossibility to confine ourselves to any particular time; we are pruning almost the entire year. Now, we will take, for instance, a man with ten or fifteen thousand trees; he would have to have an army of men to get over his orchard in any specified time, but by starting early in the season and working late we get over the trees, and I don't know but that the last trees we prune are just about as well along as the first ones. I never observed any difference. But I believe there is one thing we should bear in mind, and that is not to depend on going

over a tree once during the season. Take it along during the growing season and break off the sprouts; that would do away with a great deal of work the following spring. Cut the water sprouts off, and you will find in going along a few weeks afterwards more growing, a continuous matter all through the entire growing season. Where you don't do that you get harder clipping the following spring.

Mr. C. W. H. Heideman: Now, with reference to cutting off a big limb from a tree and letting nature take its course; it may heal over and heal without injury to the tree, but the chances are that it will injure that tree, so much so, that you would better have applied some antiseptic substance in the shape of paint or something of that kind, and protected that exposure from the germs of rot.

Mr. Daniel E. Bandmann: Suppose you cut that limb off so that no moisture or rot can go to the spot?

Mr. C. W. H. Heideman: You can't cut the limb off so as to avoid that. I want to endorse one idea that Professor Fisher has brought out, and that is, pruning should be corrective rather than curative. And if you will adopt that one principle—begin pruning just at the time of transplanting and keep it up, prune at the right time, then all this question of cutting off great big limbs would be entirely out of the case, because there would be no big limbs that would need cutting off, no saw or axe used in the orchard and no black-heart. The idea of pruning is preventive rather than curative.

Mr. O. H. Barnhill: I would like to hear Mr. Whiteside on this question of central stem, like to hear his experience, and why he thinks it best to cut out the central stem.

Mr. Fred Whiteside: My experience has been about as Mr. McClain said; each tree must be treated according to its own needs. As the President said, a great many trees that are spreading really have no central leader that requires any such pruning. A good many other trees that grow upright and with a closed head require that the center be cut out. But my experience has been that there are hardly any of the trees that will grow a central leader to amount to anything above the third or fourth limb. You will find that the first four or five limbs on almost any variety will eventually make the body of the tree. They are on the outside and get the sunlight and the air, and the

central stem being on the inside, shaded to a certain extent, and it becomes weak and small. The first few years I tried to prune so as to strengthen them, make them better, and I didn't seem to succeed, and of late years I have been cutting it out largely, and while some criticism has been made upon the fact that the tree is left with limbs which have a tendency to spread it apart, and that is true to some extent, and I overcame that in most instances by taking two of the smaller limbs on the large ones and twining them together across the tree and as low down as possible; sometimes they are only six or eight inches above where the limbs start out from the trunk of the tree; maybe a foot, or two feet. as close as I can get them and in a few years they will grow into one limb. There are a great many trees in my orchard where the two limbs have grown into one.

Mr. O. H. Barnhill: I would like to ask one more question, and that is as to the proper height to head a tree? In Iowa we find it best to use quite a low head, about twenty inches in most cases; but here the trees seem to have more of a drooping head, the limbs hang down more and don't grow as upright, especially when they have fruit on them; and maybe a higher head is necessary, and I would like to have some definite information on that point. Of course, I know it makes a great deal of difference what variety it is; but take varieties like the Wealthy and McIntosh and a few more of them, about what is the proper head?

Chairman W. B. Harlan: I wish my orchard did not have a stem in it or a trunk. I wish the limbs came out of the ground. And the nearer I can get my trees to follow that plan, the better it suits me.

Mr. C. H. Dallman: I might say that in pruning, from a nursery standpoint, (and there is where they spoil the ideal head because they cut them all off alike), it is best to take them about twenty inches from the ground at two years old, that naturally will take the leader out of your trees. It would be just right for Mr. Whiteside's planting, but for a man who wants a leader I would spoil it for him. It would be impossible to get a straight leader if you got it out of the nursery, pruned about twenty inches from the ground. But we all know very low tops are the best. In the first place, a tree pruned low would not hang upon the ground; the tendency is for it to grow up until about four feet high. Take a Wealthy, cut it off four feet, and

its tendency is to spread, but if you cut it off a foot, the tendency is to make it grow upright, and it is better for spraying and also for getting your fruit, and it shades the trunk and makes a better head. But I wish to make a few remarks on the other pruning, on the grown-up tree, with which I have had some experience, and it seems none of you had the point in view—where to cut your limb. Mr. Bandmann seems to think that you cut away from the trunk, straight up and down. That is a mistake, for the simple reason that if there is a limb coming out on the side, you have got to cut it where the collar is, a little swelling close to the body, and that is where the healing power is in the tree. The main idea is to cut the tree where the collar is. There is a little rising there, looks like a swelling, and there is where you should cut your limbs off, and not two inches above, because it will invariably die back.

Chairman W. B. Harlan: You don't want to cut that collar off.

Mr. C. H. Dallman: No; right on the edge of it; but if you cut above it, it dies back until it gets to that healing point.

Mr. Amos Estey: To people who are going to put in an orchard and cut out the leaders according to Mr. Whiteside's and Mr. Dallman's advice, there is one thing they will have to look out for. For an illustration I will tell you what happened a year ago last fall in the Flathead valley. On one side of the valley we had a severe rain, and it froze, and we had a heavy sleet on the trees, and it did thousands of dollars worth of damage in the strip where it went through. There was one orchard near me where it did a thousand dollars worth of damage to one man. On his trees the leader was cut out, as some have advocated here, and that made the top a lot of large limbs, and they were split down. Some were split down to the ground and took a third of the body with it. It nearly ruined his orchard. Right across from there was an orchard trained to a leader, and in that orchard the sleet did not do fifty dollars worth of damage.

PLANTING AN ORCHARD.

D. E. Bandmann, Missoula, Mont.

The planting of an orchard in the state of Montana does not require the same consideration of details as in any other section of the United States or Canada. The most important part in the planting of orchards in other states is the choice of soil and location. The battling against a surplus of moisture and heavy soil, drainage, and soil and insect pests disturbs the eastern orchardists, and causes a greater loss to trees in a year than a Montana orchardist suffers in a decade. We in Montana have no need to worry about soil or excess of moisture; it is in fact the reverse with us. There is not a spot in Montana where a tree will not grow, regardless of elevation or location, provided sufficient moisture can be secured towards its sustenance. We need not worry as to the chemical or humus conditions of our soil; it is the moisture which is absolutely necessary toward the successful planting of an orchard in Montana; and where there is not sufficient supply of water at command, no one should attempt the raising of an orchard. Some sections of our state, where the altitude is considerably lower, (as for instance the Flathead country) needs no such provision, but in all the higher altitudes non-irrigated trees are as a rule a failure. There are exceptions where a tree may prosper at the foot of a mountain where it can receive the advantages of the early seepage. I have a small orchard with which I experimented at the foot of the range of Hellgate Mountains. It is principally composed of sour crab and Gideons, and it is but fairly successful. It receives considerable moisture up to the middle of June from the mountain seepage and does fairly well for that early variety, but I do not believe that I could raise a late fall and much less a winter apple there. The trees are considerably inferior in growth and vigor to those of my orchard, where the water supply is ample.

Soil and Location.

Now, as to the soil, it matters very little what locality you choose, as all our soils are alike. The chief consideration that the Montana planter has to look for is the location. In choosing a proper location (taking full consideration as to the utility of his water supply) the planter of an orchard should give a southern slope, facing a northern exposure, the preference. The main

object in this is to allow the tree to remain dormant as long as possible. As long as you can keep the sun away from your trees in the early spring, the safer you will be from sun scald and winter killing. The greatest danger Montana orchards have to face is winter killing and sun scald. What with our chinooks in the winter, and the changeable climate of heat and cold in the spring, our trees have a hard time of it. Our ground is principally of light, sandy gravel with hardly any subsoil, and when exposed to a quick and sudden change from a hard solid frost to an early spring exposure premature growth begins and the sap starts to move. A blizzard sets in and lowers the temperature to 10 and 15 degrees below freezing point, and the branches that have already made a premature growth evaporate and die for want of renewed moisture, as the ground is frozen. The bark and lining tissues dry and adhere to the wood and generally crack open during the succeeding summer. I have also found that the roots have been frozen and killed by these alternate changes of heat and cold. Therefore, during these hot spells the orchard which is exposed to the south and west suffers the most.

In many cases during my inspection duties, farmers have shown me trees and asked what kind of an insect had killed them. I smiled and generally answered, "No insect my friend. God Almighty killed them because he wanted to give you better sense than to plant a tree in a climate like ours, exposed to a southern sun. Your tree is winter killed." I have lost quite a number of trees myself from winter kill, and I found that most of them were planted in a line where the sun at a certain hour glowed the strongest on that line of trees.

It is a wonderful study and proves to us how little we know of nature. That line ran almost 800 feet, picking out all such trees principally exposed to the hottest blaze of the sun from 12 o'clock to 2 o'clock. March is the worst month for this condition. Not one of my trees that stood in a northerly or northwesterly direction (protected from that ray) were touched. But this is an unfortunate condition to which the entire northwest and middle states are subjected. I have found yearly mulching with barnyard manure around the trees about eight or ten inches thick a good remedy for holding the frost in the ground. In some cases I have found the frost still remaining on the surface

as late as June. The farmer who has no location such as I describe should be careful to plant his trees leaning toward the southwest, as the prevailing wind in Montana comes from that direction. He should start the branches as low down as possible, one and a half to two feet from the bottom is high enough. It is a great protection to the trunk of the tree, especially from the southwest. It also shades the tree and is an advantage in picking them.

Preparation of Soil.

As to the preparation of soil, I advise deep plowing and always in the fall of the year. Sub-plowing for the purpose of drainage is not necessary in our country, as there are few locations where drainage is required in Montana. In the spring of the year the land should be thoroughly prepared and pulverized as if it was to be used for garden purposes. You cannot prepare your land too well for an orchard. A friend of mine in Rattlesnake valley laughed at this theory and planted 5000 trees on sod and rocks and only provided furrows to convey the water, of which he had plenty, to each tree. After the first year he lost one thousand, after the second two thousand trees and he has taken since to clearing up his land and cultivating it in good earnest.

Planting.

After I had my land in good condition I would roll it and I would not make the holes until the time arrived to plant my trees, and then I would go at it in good earnest. Now, as to the holes. I believe myself that we have all been generally mistaken in digging holes big enough to bury a two-year-old steer in.

I do not believe altogether in Stringfellow's theory, namely, that you can cut the roots close to the trunk of a tree like a walking stick, prune it completely close on top. Let a man place a square shovel in the ground and lean the top a few inches toward the southwest. Another man follows and sticks the tree in the space, while the shovel is still in the ground, two inches above the nursery mark, then gives two or three light pressures with his foot upon the surface ground, and the tree will make better headway than the one planted the oldfashioned style, with its 1 1-2 to 2 feet hole, the roots and fibers carefully spread out, soil carefully packed under the crown of the tree with your two fore-

fingers so that the tree can rest firmly. By the former method two men could plant from 500 to 800 trees per day, and what is more this method has not only been tested but is now considered the only method of tree planting in the east, especially in Massachusetts and as far southwest as Arkansas. I have never tried that method and I do not know how it would take in our state, but I certainly think that a medium between the old and the new way of planting trees would be advisable: that is, cut the roots and fibers more than half their size, make holes just large enough to place the trees in them, pack them gently and firmly into the earth, and let nature do the rest.

As to the laying out of a Montana orchard, I fear that I am oldfashioned in that I planted my trees 16 feet apart the same as every one else did in those days. There are great disadvantages in this, but I tell you there are also great advantages, especially when it comes to ripening time. The trees thus closely planted together form a remarkable wind break, and I have less wind falls in my orchard than any of those who planted their trees twenty by thirty, and eighteen by twenty-seven.

Varieties.

As for the varieties of apples, choose varieties adapted to the local environments and for the purpose for which you plant your orchard, whether domestic or commercial.

Don't be misled by your neighbor nor the advertising tree agent, but come to the Horticultural convention and listen and learn. If you cannot, make inquiry from a prominent Montana orchardist. Don't think that a certain variety which is a good apple in the east or west will be the same in the Rockies, for if you do you will be sold nine times out of ten.

I would advise an up-to-date orchardist to plant as few varieties as possible. I would not advise him to plant any summer apple at all. We cannot compete with other states for summer supply on account of the lateness of their maturity. The only summer apple that I would plant, and it can hardly be called a **summer** apple, is the Duchess. That is an apple which matures in good time when people are prepared for the apple market and lasts until late in November.

I would advise the planting of at least 25 per cent of hardy sour crab apples. This country is getting a good reputation for crab apples. Inquiries are being made for them all over the

northern states. The two best, and as far as I know, the only commercial varieties, are the Transcendent and Hyslop, which will always sell. The Martha is a poor crab but any one who advises you to plant a Whitney for market fruit, drive him away with your shot gun.

Now, as for the fall and winter apples in our lower valleys, this would be my advice: Fifty per cent McIntosh red, 20 per cent Winesap and Jonathans, 10 per cent Wealthies, 10 per cent Alexanders and Wolf Rivers, and 10 per cent I would experiment on with the following varieties: Spitzenburg, Wagner, Newton, Pippin. With such a variety one cannot fail, as 90 per cent of the above are all well tried apples and success must follow. I have omitted the Northern Spy because it is such a shy bearer. You can experiment on half a dozen varieties before you will be able to raise one Northern Spy, although a good apple.

Cultivation.

There has been a hot discussion raging in the east as to cultivation vs. non-cultivation, and a Mr. Hitchings, a very successful apple raiser, has thrown down the gauntlet to all established methods of fruit raising, by proving that our orchards need no cultivation, that it is only a question of mulching, which by leaving the crop in the orchard after cutting, produces the desired changes, invigorates the soil and gives new humus and moisture. Without going into the details of this hypothesis, it is my opinion that it may be very well for those locations where there is no need for irrigation and where moisture "droppeth as the gentle rain from Heaven", as Shakespeare says; but with us it is different. Our wealth and vigor of soil is principally produced through moisture. It is a maiden soil yet, and rich enough in humus. It principally requires moisture or, to make it clearer, a retention of moisture at a time when the evaporation by the sun draws the most moisture from the soil. Now how are you able to retain that moisture without cultivation? All the planting of the best summer clover in the world will never help you in that direction. You gain nothing by seeding your orchard down in Montana. Take a meadow after it has been mowed, how does it look on a hot August day? Dry and thirsty as if it wanted some nourishment, and it passes along the best way it can until the fall rains refresh it again, and during that lapse of

time is the period when our apples generally develop and require the greatest attention.

If your orchard is seeded down you will require four times as much water during that period, to give the trees the moisture which is evaporated by the grass. Thus what have you gained by seeding, as the work of extra irrigation is as expensive as the plowing and cultivation during spring and early summer? My advice is to plow every year up to eight years, then every second week go through the orchard with your cultivator, immediately after plowing, then twice more up to the middle of July, then let the weeds grow as much as they like. They are a protection and make humus the following year and they keep the snow on the ground.

I have heard people say that you remove the surface root by plowing. This is a good thing too. Tap-root pruning is a capital advantage to the tree. It is as good as pruning suckers. They are a detriment to the trees, and you need not plow deeper than two or three inches any way.

Pruning.

The next question is pruning, and as that is a separate subject in itself, I leave it for others to advise you on. It is an important question, however, and one which should arrest your greatest attention and care. A tree must be pruned or it will grow up like a hedge and may become an ornament, but never a money-maker.

Spraying.

Spraying is another question of importance and of a very wide character. It is the general neglect of this all-absorbing question by the young orchadist from which all his troubles afterwards spring. If the farmer as soon as he has planted his trees and cultivated the same would spend a minimum amount of money by purchasing, if he has a small orchard, a bucket spray, if a large one, a barrel spray, say of 50 gallons, and spray every one of his young trees with a tobacco and whale oil soap emulsion, and keep that up once every year, he would never see an aphid on his trees. If, in after years, he uses a mixture of paris green and bordeaux mixture, he would never see any kind of pest or fungi, or anything in any shape whatever to ruffle his mind. His apples would be far superior to those of the shiftless farmer who does not spray, and his trees would smile with a

deep broad leafy green foliage that would make his heart beat with joy. But suppose I have no insects to worry me, must I spray then? Yes. Why? Because you **have** insects to worry you. You do not know, you cannot see them with the naked eye, but they are there nevertheless. They are deposited on your leaves and trunks by myriads, and can only be discovered by a microscope. Have you ever seen a perfect milker, one who follows the doctrines of the model dairy? He changes his dress to a spotless white, washes his hands carefully when he approaches the cow, dumps his milk through the most perfect strainer and then deposits his milk in a deep setting arrangement. Now set aside the strainer and place the next cow's milk into a separator. After the cream is separated from the milk, look at the strainer and separator. There is 75 per cent more sediment and dirt left in the separator than you can see in the strainer. Look at the cream from the deep setter and at that from the separator. The deep setter cream has nothing like the pure perfect color of that from the separator. You cannot see it with the naked eye.

I will give you another comparison and then I have done. Have you ever been in your chicken house? I doubt it. Go in and you will find everything perfect, but nevertheless your young chickens die and your hens look drooping. What is the matter? Investigate carefully, more so than usual, and you will find that there are myriads of mites worrying your chickens and killing them, which you did not know about before—you did not see them with your naked eye.

Oh, my friends, there are more things in heaven and earth than are dreamed of in your philosophy. The same with your trees. They look perfect and healthy, the foliage is in splendid condition, and yet there is an ill-wind brewing. They don't seem to look as well the following year. What is the matter? Some pest or fungi or gnat must have attacked them. You examine, but you can find nothing. You cannot see it with the naked eye. You have a friend called the paris green and Bordeaux mixture. Don't delay it. Give it to them twice after blossoming time and your trees will be free from every ailment, and then you will be able to see the perfection of your clean, healthy trees with the naked eye.

Professor. Linfield: Now I think there are quite a few here

who might say something to us on this topic. I presume there are some of you who have different views from Mr. Bandmann. Are there no questions to ask Mr. Bandmann on this subject?

Mr. Whiteside: Mr. Bandmann made the statement that he would not advise us to plant any more summer apples whatever, and I would like to ask him if he made that statement without any qualifications.

A. Yes, Brother Whiteside, I really believe we are too late in the season to compete with our neighboring states. Our summer apples ripen about a month later than theirs, and the market is already flooded with summer apples from California, Washington and Oregon, who are ahead of us by four or five or perhaps six weeks. I have found the greatest trouble was to dispose of our apples—the summer apples—when the markets were flooded with Oregon, Washington and Utah apples. I could not conscientiously advise any one to plant summer apples for commercial purposes.

Q. What do you mean by summer apples?

A. Apples earlier than the Duchess and the Red June. I would not, if I were to plant an orchard today and spend \$10,000 on it, I would not plant one earlier than these varieties.

Mr. Whiteside: So far as my experience goes the summer apple is not good for the market, because all of those varieties are such that will not bear shipment, consequently there is always a great loss. On the other hand there is nothing that can be planted in an orchard better than a few trees of the summer varieties, because they are the most highly flavored and most delicious. For instance the Whitney; I do not believe there is a better eating apple grown than the Whitney. It is a delightful apple for the family and children.

Mr. Bandmann: That is true; the Whitney is a delightful apple for the children. (Laughter.)

Mr. Harlan: I will say that it has been my experience that the smaller the tree you plant the better. Most every beginner wants to get as big a tree as he can. I know of some who used to order five-year-old trees; they could not afford to wait for the small trees to grow, but now the nurserymen hardly ever sell three-year-old trees. They want a younger tree, now that they have had some experience. I would prefer a yearling for my own planting and I have had experience on a large scale. The

shock to the tree is much less and they get into bearing just about as soon as older trees. I can set out from 200 to 300 of these yearlings in a day. At one time I set out 250 of those trees in a half day and it was not very hard work. Of three-year-olds I can set out thirty in a day. This is the great advantage in buying small trees. I should like to hear from more of the farmers as to some of their experience with summer apples. Are your summer apples earlier than ours?

Mr. Whiteside: No, sir. In regard to planting trees I, like Mr. Bandmann, dug large holes for my trees, but unlike him I am not particularly sorry I did so; I would not kick myself at least. The fact of the matter is, I believe the method of digging large holes is a good one, and the method followed by Mr. Harlan is a good one. I have followed both, and my experience has been this: That for a large tree, especially where the ground has not been previously tilled thoroughly, it is best to dig a large hole and fill in with the proper kind of soil; then put in your tree, patting the earth well around the roots. When I have planted my trees I have always used a heavy stick for tamping, the same that I would use in putting in fence posts, and it is best to thoroughly tamp it because then the soil will not dry out. The method of sticking the spade into the ground, paring the roots close, putting the stump of the tree into the opening may be all right in Massachusetts, or some of the other states, but not in this state for this reason: The soil there has in it different matter than here; it has some moisture and in general it is of a different character, and the tree has a better chance; but here where the soil has not been tilled during the summer, the soil is pretty dry. You put your spade into the ground here, place your tree into the opening, and I will venture to say 75 per cent of the trees so planted would not live.

As to the method of planting a small tree; three years ago I planted an orchard of 2000; I planted 1000 two-year-olds and 1000 yearlings. Today you can hardly see the difference. The yearlings are about as large as the two-year-olds. I believe the method of planting small trees as outlined by Mr. Harlan is a good one. If you plow land in the fall and the soil is well prepared, it is certainly unnecessary to dig a big hole.

Mr. Bandmann: What would your judgment be in regard to location?

Mr. Whiteside: If you have an open location with plenty of sun, perhaps a yearling would do just as well. I know from my own experience, because I am right under a hill where the sun is kept away, at least partly, and my yearlings have never prospered as well as the two-year-olds. I planted a few of them that didn't mature, and I would advise you to consider your location. If you have an open location with plenty of sun, then take your yearlings; but if not, plant two-year-old trees; that is the right age.

Q. I would like to ask Mr. Bandmann his reason why we should plant 50 per cent more McIntosh Reds against 10 per cent Wealthy on the farm?

Mr. Bandmann: It has been proven beyond a doubt that the McIntosh apple is the most appropriate apple in every way that we can raise in the State of Montana. We haven't found anything better as a fall or early winter apple, even going a long distance into the winter, than the McIntosh; that is, so far as the apple itself is concerned. It is the finest eating apple grown; has the most delicious flavor, and possesses all the requirements necessary for a commercial apple; and now comes the most important part of all—you can get from 25 to 50 cents per box more for the McIntosh than for any other. And that is a good reason. If a man plants a commercial orchard he wants to make as much out of it as he can. The McIntosh is the most in demand of all apples, and I am sure there is no better reason to be given. You go right out in your own market and you will pay \$2.00 or \$3.00 per box. There are no McIntosh apples to be had. It is the same in Missoula. The McIntosh apple is in demand.

Mr. Whiteside: Some of us who are acquainted with Mr. Bandmann are surprised that he did not suggest 100 per cent of McIntosh Reds.

A Member: If you ask a farmer which has made the most money, either the McIntosh or the Wealthy he will say the Wealthy. In the first place the Wealthy is a very hardy tree and the McIntosh a very weak tree with me. I set out three years ago 300 trees, 100 each of Duchess, McIntosh and Wealthies. Now I have got every one of the Duchess. I have perhaps 40 McIntoshes and 100 Wealthies, and every one of them bore last year. Last year I probably got 3 bushel of McIntosh apples, and most of them are carrying green leaves today.

A. That is merely a matter of location. I have never lost one McIntosh tree, and I have planted upwards of 500. It must be a question of location. So far as the trees bearing leaves is concerned, that is an open question, and one that now moves the whole eastern country,—whether it is an advantage for a tree to bear leaves. A good many people say in the east that it is a sign of vigor and strength for a tree to carry its leaves.

Mr. Harlan: It certainly is not in this country.

Mr. Bandmann: We would like to hear from Mr. Whiteside as to the McIntosh apple.

Mr. Whiteside: While I have a good many McIntosh apples planted they are not yet of sufficient age to bear any amount of fruit. My experience is that the McIntosh apple is both a very hardy and very vigorous grower. I think out of perhaps 3000 trees, I have noticed perhaps a dozen or two that did not fully ripen or shed their leaves. I will say this: I watched all of the varieties very carefully last fall as to how they would ripen and when the seeds would turn, and I found that the McIntosh does not ripen as early as some of the other varieties—as some of the winter apples. The apples that have been grown, I believe are as fine or a finer flavor than any in the Bitter Root. It certainly is a fine apple; perhaps the finest quality apple grown in Montana. It seems to be particularly well flavored in this northwest climate.

THE BEST WINTER APPLES.

By C. C. Willis, Plains, Mont.

The subject assigned to me, "The Best Winter Apples", is one of the most importance to the fruitgrowers, as this is what will make the commercial orchard a success in our mountain state.

The climatic conditions are so different, that it is impossible for us to adopt any one or two varieties, as they have done in most of the older fruit growing states, and I will briefly speak of a few apples that I believe will prove valuable as winter apples. There is a great difference in the results obtained by growers of these apples in different localities, and it is of the utmost importance in our state, that the trees we set are of hardy varieties that will stand in our very peculiar climate.

It seems that in this state, growers and dealers have agreed

on one thing, and that is, "The best winter apples must be red", and I am afraid they are very often sacrificing quality to color.

I will name a few varieties of winter apples, if the trees are hardy enough, that are among the best winter apples produced in the United States. Some of these do well in almost any locality where fruit growing has been tried in our state. I will name the varieties I think are the best commercial apples for us: The Esopus Spitzenburg, which I believe is the best variety; Kings, Roman Beauties, Canada Reds, Bethel, Delaware Red, Gano, Walbridge and Baldwin.

Where the top is grafted on hardy stock, the Northern Spy is one of the best winter apples in certain localities. These constitute the late keeping varieties of red winter apples grown, to my knowledge, in our state. Now a few of the green and yellow varieties are the yellow Newton, in some localities; the Russéts, the Red Cheeked Pippin, the Belleflower, and the Rhode Island Greenings. These are, I believe, all grown in Montana.

In taking up a few of the best early winter varieties, the McIntosh, I believe, stands at the head of the list, and my friend Bandmann will agree with me there for once. I am told by fruitgrowers of Flathead county that it is the best winter apple they have. The Wealthy is perhaps the next in the early winter apples. There are a number of other good varieties, such as the Wolf River, Maiden Blush, and the Antanovka. These, I believe, are the leading varieties that are grown in our state. There may be some I have omitted that are as valuable as those named, but I believe some two or three of the varieties mentioned will finally be recommended by this society for general planting.

The man that sets any of these, if the trees will stand the winters of our varied climate, will surely make a success.

You must remember one thing in setting an orchard, select large apples as far as possible, as the size of all apples in our state seems to get smaller as the trees get older, and I think the day is not far distant when we will be as anxious to know the best fertilizer for our orchards, as we now are to know the best varieties of winter apples.

After looking over the beautiful parks in the city of Great Falls, and seeing the growth made by such well known shade trees as the Elm, Ash and Maple, there is no longer any doubt in my mind, that you can raise as fine apples as we can on the

west side of the main range of the Rockies; I mean of the hardy varieties, such as the yellow Transparent, Duchess, Wealthy, Alexander, Antonovka, and a number of other hardy varieties. I would not be surprised to see the best Gano and Ben Davis apples raised in Montana, grown on the east side of the range. Apple growing is like stock raising, you always have to be on the lookout for the best stock, and I want to say here, that the proper place to buy your trees, is from your home grower, as he knows the varieties that will give the best results in our state, and we have a number of nurseries to select from.

DISCUSSION AT GREAT FALLS.

Daniel E. Bandmann: That is a positive truth in what he says, that the older the tree grows—a strange thing, it seems to be more in our country than in the east—the smaller the apple will grow. Now, we have to think of some preventive against that. I have noticed it myself, even in the McIntosh I have noticed it, and he mentions it too, that fertilizing is the only remedy against it; and if our barnyard manure has not sufficient chemicals in it, science will help us considerably here to find out what other artificial remedies we ought to apply to work against that serious trouble which we have to encounter.

C. W. H. Heideman: I think the question of smaller apples is going to be solved principally by thinning out. It ought to be understood that the chemical composition of an apple is probably ninety-eight per cent water and the balance is something else. Now, the water that goes towards making an apple does not cost anything. The real chemical elements enter into the seed, and the greater the number of seeds that are produced, the greater the tax on the vitality of that tree. Consequently, if the tree is vigorous and you allow one thousand apples to mature, you are actually allowing ten thousand seeds to mature. If you thin those down to five hundred apples, you are only taxing the vitality of the tree to produce five thousand seeds, and are getting a greater quantity of weight than if you left them all on. This has been so thoroughly proven in Michigan on peaches, by carefully conducted tests, that there no one questions the utility of thinning.

Chairman W. B. Harlan: The matter of pruning in place of picking, in order to thin fruit, is being practiced in the Bitter Root Valley the last year or two, and satisfactorily. We find

that to pick off a portion of the crop of an over-bearing tree is impracticable where you have a large orchard. It costs more than it does to pick the entire crop finally, and at the time it should be done you are busy with other work and are disinclined to spend the amount of money it costs. To go over an orchard of forty acres of trees and thin them out would require thirty or forty men for a month or two months, and it is just practically out of the question; but I have found, as others have found, that we can obtain nearly the same result by taking the pruning shears and cutting them back, and now and then cutting off a whole limb close to the stem, and that can be done rapidly. This perhaps is not performing the work as thoroughly as by thinning, but it is more practicable.

Mr. T. A. McClain: In speaking about the McIntosh, if you top-graft in some other variety, I find the McIntosh, after it becomes established in the orchard, is about as hardy a tree as we have. The critical time, I find, is in the nursery; that we have serious trouble. But after we get it once established in our orchards it is there to stay. I have experimented considerably in grafting the McIntosh onto other varieties, not to help the McIntosh but to get rid of objectionable varieties that were growing on my tree.

Now, in speaking of apples, relative to marketing apples, I agree with Mr. Bandmann, that we have with us an apple that will always demand the top price. We may not be able to get it at home, but it is an apple, if we ship it in season and at the proper time, we can send it to New York or Chicago or any part of the United States and get a good price for it. When we class that as a winter apple, then we make a mistake. I think we can all agree on one proposition that Christmas is about its season. I find one thing with the McIntosh apple, that after it has passed a certain season then it begins to lose its flavor. It is not the McIntosh the first day of February that it is the first of January. It may perhaps depend somewhat on the way it is taken care of, but I think I have as good a cellar storage for apples as anyone, but it frequently does serve me that way. There has been a great deal accomplished in the raising of fruit. There is no question, whenever we go into the markets of Montana or elsewhere, that the color predominates. A year ago, in Kansas City, when apples were selling for from seventy-five to ninety cents a bushel, the red apple—the Jonathan and King—

were selling readily for from two to two and a half a box. Now mark the difference. The color predominated. They had apples on the market which perhaps in quality were equally as good as either of those varieties, but still lacking in that attractiveness which people with money were willing to pay for them.

And as advising people in regard to the location of planting those apples, they must use their own judgment. We did that in the Bitter Root valley. We had to take those chances. You may have a country here in the vicinity of Great Falls that will produce a McIntosh equal to any other place in the world; and then again it might not be a success with you. You must take your chances. Speaking relative to the apples, pardon me if I mention other things in connection with that; when we first were planting, it occurred to us that we must use nothing but iron-clad varieties, and Russian varieties were recommended to us as being the only iron-clad. Our experience is entirely different. We have varieties that are just as iron-clad as anything that ever came from Russia. Some orchardists still plant Russian varieties, and the result is we have a class of apples not marketable in Montana or elsewhere.

Mr. Daniel E. Bandmann: I thoroughly support my friend here, but the only issue I take with him is this, that the McIntosh is certainly a longer keeper than to Christmas. I know you can't keep the McIntosh up to the end of February, and I disagree with him that it loses its flavor. That is one of the beauties of the McIntosh, that it generally keeps its flavor.

Chairman W. B. Harlan: I found after that cold weather five years ago—it was a pretty severe test—that the young McIntosh trees were injured, but the old trees were not injured at all. The old trees stood as well as any of our hardiest trees, but the young trees, planted only a year or two years before, were injured along with other varieties.

Mr. Daniel E. Bandmann: I haven't any young tree, but I haven't lost one McIntosh tree after that cold winter, nor one Duchess tree, but I have lost quite a number of Ben Davis.

Chairman W. B. Harlan: I wish to say in regard to Mr. McClain's remarks in regard to Russian apples, that while the Russian apples were boomed a great many years ago, and a great many poor varieties put upon us, we have Russian varieties which are our stand-bys and which are so old with us that we

fail to remember them as Russian varieties. The Duchess is a Russian variety, the Alexander and the Yellow Transparent, and Red Astracan; and they are four of our best varieties.

SOME HINTS ON BEAUTIFYING CITY AND COUNTRY HOMES.

C. W. Heideman, Missoula, Mont.

"Beautiful surroundings increase values and refine—Ugliness and filth cheapen and degrade."

If there were no other reason than the above for making the home grounds as inviting and convenient to live in as home rooms; no apology would be required on my part for attempting to offer some suggestions on how to beautify city and country homes. I shall touch upon but a few of the many details of the art of landscape gardening and the hints I have to offer, will be in the hope that they will induce or aid some home owner in making a lawn, in planting a tree or some shrubs and vines. These hints have been gleaned from experience and the accepted principles of the modern or natural style of landscape gardening. You don't need a landscape architect to tell you that it is proper and in good taste to plant a group of trees on your grounds for shade, or for a swing for the children. Or a hammock for the older ones in summer. You don't need him to tell you of the beauties of a row of street trees, or a double row of Lombardy trees along the lane. Do as many others have done—look to nature for some models and plant in accordance with the requirements of your own surroundings. Your first study should be to make the arrangement a simple one that can be easily maintained, always keeping in mind the space available and the ultimate size of the trees and plants to be used.

Roads and Walks.

Only such roads and walks as are actually required for constant use should be provided. The guiding principle in designing the position of roads and walks is utility. Nature forms no roads. They are the works of men and animals, and would undoubtedly always proceed in straight lines from point to point if obstructions of various kinds did not interfere and cause deviations. Necessity will therefore suggest where and how they should be introduced. The beauty of curved lines some-

times prompts to a deviation from the more available direct course, and, where it can be done without too great a sacrifice of utility, it is not objectionable. Conform in general to the prevailing custom on the street as regards the use of fences and plantations between buildings and street lines.

The Lawn.

A fine lawn is the most beautiful of external ornaments, and after roads and walks should be our first consideration. There is scarcely a front yard in the state but what could be made more beautiful by a nice, well kept lawn alone. Keep the centers of the lawn spaces open and make plantations in dug-over beds at the edges of the lawns instead of dotting them all over the grass, thus securing the full value of the lawn area and making maintenance easier.

Where and How to Plant.

Locate plantations and select plants with such definite objects in view as the separation of the working grounds and storage yards from pleasure or playground, screening and hiding objectionable objects and views, framing in lawn spaces, and making breaks in blank walls and architectural lines of buildings and in abrupt lines between the buildings and the ground. Use but few large trees in small places. In grouping shrubs and small trees the tallest species with a tendency to lose their lower branches should be used in the center of beds and the lower growing species on the outside next the turf. Refinement of detail and additional variety may be secured by the use of herbaceous plants on the edges. A few reliable varieties used in large quantities will be better than many varieties in smaller quantities.

Vines.

Vines should be used freely for the purposes of covering walls, fences or buildings where the planting space is too narrow to allow of the use of trees and shrubs. Such high growing vines as the Virginia creeper should be trained up the corners of buildings to gables and chimneys. The smaller growing Clematis Wisteria to piazza roofs and on fences, and the still more delicate vines to low piazza railings and posts.

Flowers.

Provide for flowers in the edges of border plantations or in a clearly defined flower garden, not in separate and scattered

flower beds on the lawn. Now I have but barely touched on a few of the principles of landscape gardening, but it is enough for a beginning. The points which I wished to bring out and impress upon your mind are: That the location of roads and walks should be mainly governed by utility. That a fine, well kept lawn is of the greatest importance and the most beautiful feature of the front yard. That the lawn space should be kept open. That the main plantations should be at the edge of lawns in irregular shrubbery borders and in groups. That plantations should be made to separate the front from the back yard. To hide objectionable buildings and objects, and at the base of buildings to merge hard angles into flowing lines of landscape. Surely enough has been said for a starter, more would be confusing. Try the lawn and a few trees, shrubs and vines this spring, following the principles laid down for their use, and see how much it will beautify the home grounds. A few shade trees for street planting; some vines for the porch. A bed of roses will work a wonderful transformation. In almost every portion of the state there are many native trees, shrubs and plants that are adapted for this work. Use them freely. A group of native willows sloped down with native shrubs and plants—just as you have seen and admired them in nature—can be easily reproduced and if rightly planted will be an ornament and a thing of beauty.

A beautiful lawn with shrubs and flowers will be an incentive to clean and tidy back yards, and will encourage your neighbor to do likewise. Make the home grounds as beautiful as the home room. Your reward will be increased value and a refinement that trees and shrubs and flowers will surely bring.

DISCUSSION AT GREAT FALLS.

Mr. Daniel E. Bandmann: I would like to ask Mr. Heideman if he wouldn't give us a lesson on laying out a lawn where it gets ten below zero, as it does at Missoula, where I live?

Secretary C. W. H. Heideman: Unless I had a plan of surroundings, I could only offer a few general suggestions for a country home or a city home. I presume perhaps the principle of landscape gardening applies the same in a climate of twenty below zero as it does in a country having a temperature more moderate. In your neighborhood you have the mountains; you have natural scenery, natural features, that the landscape

gardeners of large cities would give thousands and thousands of dollars to reproduce. You have beautiful scenery on a large scale, a grand scale. What you want is refined scenery around your home. My idea would be a beautiful lawn. Let the question be decided by utility. Do not introduce any roads or walks for the purpose of adding to your landscape, for, as I say, nature makes no roads; they are a matter of convenience. And if you do not plant a shrub or a tree, just go to work and make a nice lawn. A beautiful lawn, well clipped down is one of the prettiest features of a landscape. Wherever you go in nature and see a nice open vista where the grass is growing, it is simply beautiful.

W. B. Harlan: I would like to ask Mr. Heideman if it has not been an established rule, in laying out roads, not to lay them straight, in an approach to a house, although that would be the height of utility.

Mr. Heideman: Now, I have given you the opinion of Mr. William Saunders, who has been recognized for the last 35 or 40 years as the Government Horticulturist. He has charge of the government grounds there, and he enunciates as a principle that utility is the sole guide. With reference to laying out your grounds, while beautiful curved lines are not objectionable, and where they can be introduced without detracting from utility, then it is a beautiful feature. You are probably aware of the fact that there is such a thing as extreme curve. I have been in parks where there were beautiful curves, and after the grass was all up nicely, you would find there was a short cut. Human beings will not follow arbitrary paths; they follow paths as a matter of economy; they follow a graceful curve. A graceful curve will rest the mind, but when it comes to geometrical curves, they follow right across it.

Live Stock.

THE PURE-BRED ANIMAL.

By Prof. F. B. Linfield.

A pure-bred animal is one that has been bred along one line for a great many generations, or until its characteristics are fixed and defined. A pure breed of stock is a breed of animals that is separated from others of the same species by distinct characteristics that are so fixed by heredity as to be invariably transmitted. Sometimes the word "thoroughbred" is used instead of "pure-bred," but the latter term is more accurate and more expressive. It implies that the animal is not mixed with others whose characteristics are different or indefinite; the animals are pure, free from any adulteration in their blood.

In looking over the sales list of pure-bred stock as reported in the various stock papers, we are impressed with the fact that these animals command a price much beyond what they would were they to be used for the production of meat, milk, wool or labor. We are thus led to inquire what it is in these animals that gives them their superior value. It is not alone because they have superior form or possess superior qualities, but because they represent a force which makes it possible for them to transmit their good qualities to their offspring.

I would like to impress upon all breeders the importance of looking at pure-bred stock as a force. In dealing with life it is true that our knowledge of its action under varying conditions is very limited indeed, so that under the best circumstances the results of any method of breeding come in the field of probabilities, not of an exact science. Yet with an animal possessed of valuable qualities, which has behind it an ancestry of many generations possessed of like valuable qualities, strongly developed, the probabilities are that such an animal will produce offspring possessed of qualities similar in kind and degree to their own. If we build the family tree, or in other words tabulate the pedigrees

of any animal, we are forcibly reminded of an immense wedge. If all, or even the majority, of this ancestry are strong in the possession of some definite and valuable qualities, without any marked weaknesses in any line, we find in the animal the concentrated essence of past generations. An animal with such a pedigree, like the unbroken wedge of the Saxon King Harold at the battle of Hastings, which represented discipline and unity of purpose, is able to drive its way through any opposing force, and leave an impression that will be prized through many succeeding generations. It is only when the wedge is broken by some marked weakness, the introduction of individuals of poor or unstable qualities, that the results are unsatisfactory or disastrous. Purity of breeding is essential, as it is only by the accumulated effects of a large number of generations, bred for a definite purpose, that sufficient force can be developed in the animal organism to overcome all opposing forces and predominate in the offspring. It must not be forgotten, however, that the definite purpose for which the animals are, or have been, bred must be such as to render them more useful or more valuable to man, and that all the ancestry, but more especially the last four or five generations, were strongly marked by these valuable characteristics.

All animals have a pedigree, all animals have a family tree, but our common stock fail to transmit their qualities with any certainty because their ancestry did not represent a few definite but rather many different qualities. It is undoubtedly possible through a series of years (it would probably take a lifetime) and by careful selection, to create a valuable breed even from the common stock, but is it worth it, or can the ordinary farmer afford it? Moreover, the breeders of the present pure breeds (which are suited to almost all varieties of conditions), if they were improving their opportunities might still be far in the lead. The common stock of the country may be most quickly and economically brought to a high standard of excellence by selecting the best females to be had, and mating them with a pure-bred male. The male represents half the herd as regards the progeny so that his selection should be carefully looked after. As explained above, the high-class, pure-bred animals represent the accumulated energy of many ancestries concentrated in some particular direction; such an animal when mated to common-bred stock is similar to an enormous force applied in one direction meeting many forces applied in many directions. Is it any

wonder that the characteristics of the pure-bred male should predominate in the offspring, and that a rapid improvement is effected in the offspring of the animals so bred? It should not be forgotten, however, that there are many modifying influences. Surrounding conditions, training and feeding have much to do in giving the breed characteristics, and these should be considered in our breeding operations. Again, all animals are not as strongly bred, or in other words, have not an ancestry with equally strong characteristics, and so represent a much less force than others. It should be noted also that many animals of the common stock are grades and thus represent in a measure, greater or less force from some pure-bred animal, a force that may modify the results from the use of an animal of some other breed. This is particularly the case if the animals used are very different in type or functions; in fact, to breed such animals together is often to invite disaster. It is a crossing of type which is very likely to result in degeneration, or the atrophy of useful qualities. This result is much more marked in crossing the light and heavy draft horses than is the case with cattle. Marked success, therefore, can only be obtained by breeding the animals persistently toward one type.

I said before that environment, training and food, had much, perhaps all, to do with giving characteristics or qualities to any breed. Different breeds of even the same type are thus the result of different forces or, perhaps more correctly, of very similar forces acting under different conditions. This perhaps explains why it is not generally advisable, judging from the results, to cross two pure breeds of the one type, as their similarity of type, resulting from different causes, they do not nick (to use a breeder's term), and thus ancestral or original characteristics may become dominant. It is as though we were bringing together two strong forces representing the useful qualities that have been engrafted upon the breeds. The angle at which the forces strike will determine the resultant—the offspring. When we remember that in breeding, the offspring represents the forces united divided by two, it is at once apparent that even a slight divergence in two strong forces representing the useful qualities that have been engrafted upon the breeds. The angle at which the forces strike will determine the resultant—the offspring. When we remember that in breeding, the offspring represents the forces united divided by two, it

is at once apparent that even a slight divergence in two strong forces may give us an inferior animal to either of the parents, and a great divergence may neutralize all the engrafted qualities; thus the animal reverts to the original type. Don't mix breeds; the chances are against such a practice resulting in any permanent improvement, and at the best the results are far from satisfactory. Still more strongly would I impress the folly of using a cross-bred sire on the herd. If crossing tends to neutralize the engrafted or especially valuable characteristics in the offspring, to use an animal that is the result of such a method of breeding on common stock is to invite disaster. A cross-bred animal is very little if any better than the scrub in improving live stock.

Judging from the practices, many farmers seem to think that a half-bred male is as good for improving their stock as a pure-bred. This is not the case, for several reasons. When we bear in mind the facts mentioned above that the male represents half the herd, to use anything else than the best pure-bred animal procurable means much slower improvement. To use a half-bred male shows the user has some faith in the pure-bred blood but his method of using it would tend to destroy what little faith he had; systematic and rapid improvements is not possible from this method of breeding. We call the offspring of a pure-bred male and a common-bred female a half-bred, or a grade, because we are working up toward the pure-bred standard. If we cross the female offspring again and the next generation yet again with the pure-bred, we have three-fourths and seven-eighths-bred animals, or what are called high grades. The term is similar to that we use in speaking of a hill—the grade of the land. If now we would take the half-bred animal, if a male, and mate with the common stock we get a low grade, theoretically only one-quarter pure-bred, going down, not up hill. From the practical standpoint, however, the results are not generally so good as this. An animal which is only half pure-bred is impurely bred, the qualities are tainted, impaired, and we have no guarantee as to what they are. Again, the force which the pure-bred represents has been weakened. By being mixed with the heterogeneous forces of the scrub they have lost much of their impressiveness and stability. Like the mighty image of Nebuchadnezzar, with its head of gold, its body of silver, its thighs of brass, its legs of iron and its feet of iron and clay, it stands upon an unstable foundation. The iron and clay may be mixed together, but they are not united. Having

an appearance, perhaps a name of strength, yet the clay is the true measure of its stability. As the stone from the mountain which, striking the feet of the image, destroyed it and scattered it to the four winds of heaven, so he that builds his hopes upon the use of a half-bred sire, however grand his hopes may be, is building them upon that which but invites their destruction. The very great value possessed by the pure-bred is that its forces are known, and may be depended upon to work almost always in one direction. The half-bred animal being half a scrub, may have his forces, his tendencies to improve, or engraft valuable and useful qualities so changed as to render the direction of their action uncertain. The results of breeding such animals cannot be depended upon with any degree of reliance.

Agreeing then that the improved pure-breds are a necessity in effecting a rapid improvement in our live stock at the present time, the next question is what bred shall be used? This question may be best answered by deciding on what a person wants to do with them; what are his facilities for caring for the stock and what breed or class of stock does the farmer like best?

If a person wished to go into the dairy business it would be the height of folly for him to buy a Hereford or Polled Angus sire to head his herd. It would be nearly as foolish a proposition as for the breeder of beefing animals to head his herd with a Jersey. We must in every case consider the qualities which the pure-bred is capable of transmitting. The Hereford and Polled Angus are built and bred to produce beef, a large amount of the best quality of beef; to produce milk has not been required of them. On the other hand to produce milk at a profit has been the only thing that has been asked of the Jersey. This thought will apply in thinking of all classes of live stock; we must know something of the capabilities of each breed.

Again we must not forget the animal life (might I not say all life in its various manifestations?) is largely what it is by the force of its surroundings. Animal life adapts itself to the conditions under which it is placed. Might we not with equal truth say that the conditions modify the animal? It would be almost impossible to maintain the large, low-set chunky form of the beefing type for many generations on the range. Such size and form are the result of intensive feeding and management, and so, for range cattle, continual infusions of blood from these strains produced on richer land are necessary to maintain the size and

improve the beefing form of the range stock. However, I am doubtful if too large a percentage of this blood direct from the lowlands would be the best for the range cattle, as it might impair their hardiness, a very great essential for range feeding.

The Jerseys and Holsteins were produced on some of the richest farming districts in the world. They are the product of good food and the best of care. It would not be rational for us to expect those animals to do well under the very careless treatment very many farmers give their cattle. Are we prepared to give to these animals the large measure of good keep that has been so instrumental in producing them? If we are not we must not expect to attain the best results from these breeds.

It is not wise, either, in selecting the live stock to be used on the farm, to disregard our taste. Some men have a strong dislike for certain kinds of live stock, or perhaps for certain breeds. I believe as a rule a man will do best with that class of animals for which he has the strongest liking. I would advise to weigh well the selection of the kind of breed of stock with which you wish to work. But having considered the situation from all its standpoints and made your selection, stick to it; through the ups and downs of markets and prices, keep pushing along in your chosen lines. In live stock farming, perhaps more than in any other the importance of persistency of effort cannot be too strongly insisted upon. It takes years to attain high results—ten and even twenty years may pass before we attain to phenomenal results. He who changes every year or two is lost; he soon gets discouraged and gives up. The fault lies not with the stock but with the man.

It is not possible for very many farmers to start a herd of all pure-breds, the first cost would be too great. It is perhaps just as well that it is so as it requires considerable experience to handle these high-priced cattle with financial success. The wise plan for most of us is to start with a good herd of common stock, and grade up with a pure bred sire. As said before, the sire is half the herd, thus the importance of getting first a good animal as an individual, but perhaps yet more important for use on common stock an animal with a good pedigree.

In the pedigree two points should be considered: first the animal must be purely bred and, second, the immediate ancestry must be made up of animals which were strong in the qualities desired to be built up in the herd—the pedigree of the perform-

ance. The first gives the animal the power to transmit his qualities markedly to his offspring, the second tells us the character of the qualities and is a guarantee of their value.

A few illustrations might enforce the above facts. A few years ago the experiment station of Utah started to work along the lines advised, in the building of an improved herd of dairy cows. They are just beginning to get results. They selected good common cows and started breeding to a good pure-bred dairy sire. Not one of the heifers raised has failed to produce 200 pounds of butter in one year and nearly all of them come in at 2 years old. One of those heifers produced 284 pounds of butter fat, the equivalent of 350 pounds of butter, as a two-year-old. If the dairymen of the state would heed the lesson, the dairy products of the state could be doubled in the next few years without in the least increasing the number of cows.

The importance of the right kind of blood in the beefing animal was forcibly illustrated in an experiment conducted at the Iowa experiment station. Among a lot of cattle of several different breeds fattened in an experiment there were a highgrade Hereford and a high-grade Jersey. While a comparison between these two would perhaps exaggerate the advantages of the best beefing form, yet it may be all the more valuable as it presents the difference so much more prominently. Contrary to what very many would expect, the difference in these steers was not due to any difference in the gain made per day or in the economy of the food used. Each steer while in the test gained two pounds per day, and 100 pounds of feed made just as large gain on the Jersey as it did on the Hereford steer. The great difference noted was when the animals were sold. The Hereford sold for \$6.62 per 100 pounds, the Jersey \$4.50 per 100 pounds, a difference of \$2.12 or \$25 for a 1200 pound Hereford. But why the difference? First the Jersey steer dressed 57.5 per cent of his live weight, the Hereford 67.5 per cent or 10 per cent more. The Jersey had 245 pounds of loose tallow or suet on a 763 pound carcass or 32.1 per cent while the Hereford had 133 pounds of loose tallow on an 888 pound carcass or only 15 per cent. In addition to this the meat of the Jersey was not as good and was valued at less when cut up on the block. The gain on the Jersey steer was laid on around the internal organs as suet, worth four cents per pound; the gain of the Hereford went into the high priced cuts worth 15 to 20 cents per pound—\$25 difference in the value of a finished steer

according to his breeding. Can we afford to invest in the improved blood? Rather, can we afford not to do this?

Did time permit I might present equally as strong illustrations from other classes of live stock kept on the farm—horses, sheep and poultry. I want you to think of these things, study them carefully and apply them in your own work. Weigh well your choice of stock in the light of your surroundings, your tastes and your markets. Get the best pure breeds available; animals strong in individual merit and in lineage. Keep always before you a high ideal; follow it intelligently and persistently and your reward shall be sure and lasting.

CATTLE RAISING IN BEAVERHEAD.

By Ernest Orr. Dillon.

The Breed of Cattle.

It seems that the breeds of cattle best adapted for beef purposes in this country are the Shorthorn and Hereford. In regard to milk cows I am not prepared to state just what breeds have proved to be best as I am not sufficiently acquainted with this subject to say.

However, to all appearances the Shorthorn is the best breed of the two, when they are left to run on the range until they have attained the age of four years, as they make the largest steers of any cattle, in my estimation; although the more the herd is improved the greater the difficulty will be experienced in wintering, as a full blood Shorthorn will die on the range where a Scrub or Texan steer would winter in good shape.

Shorthorn steers on the range are seldom ready for market until they are four years old, as they are tall and lanky at the age of two and three years, then filling out to splendid animals at the age of four years. On the other hand the Herefords, or "White-face," as the range men call them, are in good condition for marketing at the age of two, three, or, four years, although they are not equal to four year old Durhams. This of course applies only to cattle on the range for when fed properly, they make fairly good beef at any age.

The Winter Range.

Strictly speaking we have no winter range, the stockmen of Beaverhead and Madison Counties have been forced to gather

their cattle in the fall, and keep them in pastures or feed them at least five, and in some cases six months in the year, this is caused by the encroachment of sheep on the cattle ranges. It is well understood by the stockmen that they will have to abandon the industry of cattle raising when the sheep become too numerous.

The Summer Range.

Practically the only summer range left for cattle in Beaverhead county is in the Big Hole Basin. It is similar to the Centennial Valley in Madison County in that it is too far from the shearing pens to make a good range for sheep. However, there will be eventually no range for cattle or even sheep, as in California in some places the ranges are so badly run down that stock is turned out neither summer or winter. Unless the Government takes it in hand and apportions certain ranges for cattle and sheep, which it seems they are trying to do in Madison County, (known as the Madison Forest Reserve). There will eventually be no range for cattle or sheep.

In conversation with the agent of the reserve a short time ago he stated that the intention of the Department of the Interior was principally to protect the range, which in my estimation, is the only salvation for cattle ranging in this country.

As to whether it will pay to raise cattle here as they are raised in Iowa, I am not prepared to say, as I am not very familiar with the method of raising cattle in Iowa, but hardly see how any comparison can be made with a corn raising state. As I understand it, enough can be raised off one acre of corn to winter several head of cattle, which would be impossible with hay ground. However, if the ranges are protected in such a way that stockmen may range their cattle a part of the year it will remain a profitable business. When taken in connection with hay raising it seems to be very profitable; that is, feeding stock on what is raised in order to have them ready for spring beef, or simply to winter them. This has been carried out in the Big Hole valley in this county and the Centennial valley in Madison county, until it has attained to almost perfection. These two places were forced to feed in winter on account of the deep snow. Ranchers found they could fatten cattle for the eastern and western, as well as for the home markets, on hay alone which at one time in the history of this country was thought to be impossible. In some localities the large herds have been diminished on account of sheep until they are now little more than sheep ranges, while

in other localities they have held their own. Owners of large herds can see the time coming, and at no great distance in the future, when the large herd will be a thing of the past, as the old time cowboy is to-day. However, there is an increase of small outfits which in a great measure makes up for the decrease in large herds.

In regard to the Choteau County range, I can say that it is a large rolling country with scarcely any limit to the distance that cattle may travel over. It is a range where it is impossible to hold a large herd in such a way that they may be looked after as closely as they are in this country. Owners of large herds simply let them drift over the country as they will, from the Marias on the south to the Cypress Hills on the north, a distance of 200 miles. There is no chance at present for the profitable farming of this land as it is too far from market.

Discussion at Dillon.

Mr. Decker: I would like to know whether or not we are on the right trail for wintering. The course that has been pursued for the last fifteen years is to get the cattle in off the range, and hold them through the winter, then to get them out in the spring. We expect 5 or 10 per cent to die. It occurs to me that we make a mistake, taking the conditions that exist here, and trying to do as we did twenty or thirty years ago. When an animal comes in weighing 800 lbs., we should see that it doesn't fall off 300 lbs. during the winter; rather see that it weighs at least 900 lbs. in the spring; keep them moving right along; it seems to me that if we knock off 300 lbs. in the winter we are not making money.

Mr. Featherly: I don't see why it would not pay to feed cattle in this county, like they do in the state of Iowa; why it would not pay to just keep the number of cattle we can take care of and not allow them to fall off three or four hundred pounds during the winter and allow lots to die for the want of feed. This question is going to confront the people before very long, whether or not it will pay to take care of our cattle in Montana like they do in the east, where they have a much smaller area and many more cattle. I have about 1500 head of cattle. They wintered through pretty well but it doesn't seem to me that it would pay to feed them hay worth \$5 a ton at the present time.

Mr. Decker: I think it all comes from the conditions that exist here—this hoggishness—we want to get through and we don't

want it to cost us anything. Why we have got a better place to grow hay than they have in Iowa, and a fellow who was through here from the east the other day told me this was the cheapest place to feed, and we can get a larger number of cattle out on the hills. I believe this is as good a hay country as there is anywhere and good hay will keep stock moving right along, and it ought to pay to feed hay at five dollars a ton half of the time and keep them on the range the other half especially where we don't have any pasture to pay for. I believe it is all our hoggishness; we want to make money too fast.

Mr. Robinson: I would state that I keep a few cattle for domestic purposes. I keep them on the farm the entire year. Of course I have tame pasture irrigated. I sold some of those last winter and each of the cattle were just about two years old, and they weighed something like 1600 pounds. They paid for the pasture and all the hay and a little profit beside. I can't see why it wouldn't pay to take care of the cattle so that the two year old would about equal the four year old. You could get them off your hands very much earlier and they are fatter and better eating. I don't see why it would not be profitable when we can turn them out in the summer on free range; then it does not take them the whole summer to start growing again. Those who have had more experience could probably tell you more about it.

Mr. Decker: That is a new revelation that two-year-old cattle could weigh 1600 pounds, some of our two-year-olds don't average 1000 pounds. Does it pay to keep steers until they are four years old? That is the question.

Mr. Robinson: I fed a lot of steers last winter under contract. Parties had bought them for the Seattle market and they were not in a condition to ship although they had been fed some hay, and I fed them this black clover. I couldn't have sold it at any price in the market. I fed for 47 days and when I weighed them they had made a gain of $3\frac{1}{2}$ pounds per day; among those were some four-year-olds and they averaged about 1040 lbs; the two-year-olds weighed something over 1200 lbs.

Mr. Decker: I have seen one man lose enough cattle in one winter to make quite a large herd. So has everyone of you here present.

Mr. Featherley: That was in the early days.

Mr. Decker: Yes, but since then. My friends up on Horse Prairie every year lose a herd or two; yes, and have stacks of hay

to carry over. I believe we just float along and let it go because that is the way they used to do.

Mr. Robinson: In regard to this black hay that we have used in connection with our feeding, one of our neighbors fed some cattle this winter, and he was feeding them on damaged hay—as we call it—but he had about 150 tons of very bright clover hay, it was just as bright as it could be, which he was saving to finish the cattle, at first they almost refused to eat it but after they did get to eat it he found they were going back; he fed about half and was compelled to go back to black hay in order to finish his cattle. We claim that the hay that turns black when stacked is best for feeding. Hay that will not mould but will get black we believe to be in the very best condition that we can get it from the field, and I think that anyone who has had any experience in feeding will bear me out in that statement.

Mr. Noyes.—Recalling what our friend Colonel Decker said about feeding cattle as a paying proposition, I will say that England is noted for producing the best classes of cattle in the world and they use the cattle for dairy purposes until they are 7 or 8 years old and they consider they are then in the best condition for marketing and get the best prices for their cattle. In that case it would be necessary to keep the cattle moving from the time when they are born until going to market. Now, it is a fact that the range cattle in Montana are better cattle than are found on the average farms in Iowa, Wisconsin or Mississippi. Of course in the east they have an advantage over us in that they have a great variety of feeds and they can raise a number of fine breeds that we cannot raise, while we have but a few feeds that we can give to our cattle. Take for instance the Kentucky blue grass; two head of cattle will live on one acre, and it would take 40 or 50 acres of our range pasture. Again, the east has an advantage over us in being close to the markets. Were you to start your cattle for the east today you cannot tell how the market will be when they get there, it may be high or it may be low. In all cases I think it pays best to get the best cattle, feed them the best and keep them going all the time. I think a man who has only a small number of cattle and takes care of them will realize as much as the man who has a great many cattle and doesn't take care of them. It is absolutely necessary to make some provision for winter. I remember in the winter of 1874 and 1875 in Deer Lodge valley, I had a bunch of cattle. We

never made provision for the winter, the grass was always knee high and we didn't think it necessary, but this winter the snow was knee high too, and the result was that out of thirty head we had only about 15 head left, when if we had made some provision for those animals we would have saved every one.

Messrs Poindexter and Orr have raised Shorthorns and have been very successful with them; I say, buy good cattle, no matter what you intend doing, if the price is anywhere reasonable. It is just a question which kind you like the best, the Shorthorn the Hereford, or the black cattle. In wintering some cattle one winter I noticed that the Herefords came in fat, the cows were fat and the calves were fat, but I never saw so many bones as the Shorthorn family presented. The Herefords and Shorthorns have been known to thousands all over the United States. If you like the Shorthorns, all right. If you have good cattle and feed them well you will certainly make some money out of them.

CATTLE RAISING.

By W. Crowell of Dillon.

After what has been said about the monopoly of time by the sheepmen, I was in hopes many more cattlemen would express their views of the work they are doing. My main stock is sheep, but, as it is with the stockman in the eastern states where one kind of stock follows another, as hogs after cattle, so to a certain extent is it true of the sheepman, whose fields will always contain some feed not relished by the sheep. This feed I keep a few head of cattle to consume.

Before taking up what I intend to say upon this subject, the thought has come to me whether or not we are all taking advantage of the wonderful amount of information that may be had for the asking; knowledge that not only costs us nothing but is the very latest results of the research of our highest authorities—I refer to the bulletins issued by the Department of Agriculture and the Agricultural Experiment Stations. The livestock and agricultural journals always announce the publication of bulletins of general interest and value, and while I am not prepared to say that agricultural colleges of other states will mail their bulletins in reply to all requests from whatever lo-

cality they may be made, I do know that I have never been refused except in one instance, where the supply was short, and have received copies from the majority of the colleges now existing, even from some of those in Canada. If there is any question as to the practicability of the methods advocated by these schools, need we do more than point to the very large number of farmers who have farmed all their lives that crowd the classrooms of agricultural colleges far beyond their capacities during the special short courses of study furnished in the mid-winter season for their benefit, while but a few years ago they scorned the idea of a school-taught boy competing with a practical farmer in stock judging, feeding, dairying, selection of seed corn, to say nothing of corn breeding and all the other departments of their work. They have all conceded his superiority and are enthusiastically drinking from the same fountain of knowledge.

Now what do the bulletins and the markets themselves tell us of the topic under discussion, viz: that of cattle raising? The markets of late years tell us that what is denominated as baby beef has the call and that it commands in its finished form the very highest market price, as it is rated as the very highest grade; this price being as much as one dollar and a half to one dollar and seventy-five cents per hundred more than other good grades.

Now the bulletins tell us that baby beef is finished beef at from twenty-two to thirty months of age and what I may say here concerning the feeding of cattle applies equally well to baby mutton, hogs, etc., and further that it is a proved fact that young stock will put on more weight for a given amount of feed than older ones, and there is consequently a greater economy of feed aside from the fact that it marketed at a much earlier age, avoiding the many risks of accident, by reason of its shorter life and allowing the investment to be turned over that much oftener.

Now, the article which forms the basis of the discussion says that usually our three-year-old steers are not fat but long legged and inclined to be scrawney and are not ready for market until they are four years old. This should not be so and must surely mean that they have not wintered well, and instead of being fed enough during the winter to keep them in good growing condition, at even the same or slight increase of weight until the grass comes in the spring, they have had to rustle upon pasture with little or no hay and instead of holding their fall weight have lost

from two to three hundred pounds. To have a hard winter and lose weight during the first year of an animal's life means to forever stunt it. Not only will it never grow so large as it otherwise would, but it will not be so thrifty and a given amount of feed will not produce the standard gains of flesh. While to lose weight during any winter means that a large part of the succeeding spring and summer will be required to enable it to regain its weight of the preceding fall and but a fractional increase of what it would otherwise make in the season must be the result. If any principle of live stock raising has been discovered and settled, whatever form of animal life it may be, it is that the animal to do the best for itself and for its owner must never know the lack of food during the early period, usually the first year of its growth; and more than that, the food should be so selected that it may contain the elements necessary for its growing muscle, bone and fat, for only in this way can the foundation be laid to produce an animal typical of its breed. What is the use of going to the expense and trouble of getting pure-bred or even grade stock if we are not going to feed it in a way to enable it to develop true to type? I do not mean to say that this method of handling stock is the rule, yet we are all perhaps prone to have in mind during the winter that range is free and costs nothing and if we can just get our stock through the winter they can pick up on the free feed of the spring grass. I will not stop to summarize what I have said to show you how costly this latter conclusion is and what a serious fallacy it contains. Surely enough has been said to give you a realization of it.

MANAGEMENT AND BREEDING OF LIVE STOCK.

John W. Pace, Helena.

As Mr. Wylie told you to-day, the cattle we saw near Choteau and Collins were not of the class of cattle that Montana can raise. This section of northern Montana has always been recognized more or less as strictly a range country, and up to a very few years ago, I might say two years ago and less, it wasn't difficult to find men who would tell you that Montana wasn't fit for anything except a range country, and never would be; that whenever the range business was disturbed that the entire

economy of the state would likewise be disturbed. In my visits over the state of Montana—I try to get over once a year—I find that the thinking class of stockmen, of farmers and of citizens generally, are accepting the certainty of the changed condition. We have reached the point today where our farming progress and farm production are growing faster than any man realizes, unless he takes the trouble to personally investigate. I can state to you the fact that in Gallatin county, land has increased twenty-five to fifty per cent in value in three years, and the farms have decreased in size fully fifty per cent. It shows you that there is absolutely a changed condition, and that changed condition affects nobody, no class of men, no class of our producing citizens, so much as the stockman. We have certainly reached the point in Montana when we have no longer got twenty acres of land to devote to one steer. The encouragement of the settler is a God-given right, and the march of civilization towards this Northwest empire is just as certain as it was in Nebraska, in Minnesota, in Colorado. And the sensible thinking stockman and farmer will arrange his plans to meet it, and he will meet it manfully and cheerfully without a grumble if he is made of the right stuff. We have reached the point now when we must produce, if we can, the same weight of steer at two years or two and a half or three at the most that we have been taking four and five years to produce. We have got to that point now, where, if we take four years to produce a steer, our average thirteen or fourteen hundred pound steer at four or five years and over, if we take four years of time to produce him and take twenty acres of land upon which to produce him, as we have been doing, there is no longer any profit in the business. We have reached the time, by the admixture of good blood and by the running of pure-bred steers, with the herd advancing all the time, and keeping the calves growing from the very time they are calved until they are ready for market, we have reached a state of agricultural efficiency when we can, with care and study and thought, produce as much beef at two and a half or three years as we have in the past been devoting to four to five years to do.

Now that leads us up to the question of breeding. The question of breeding is one on which all classes of men will have their individual opinions. This man likes the Shorthorn, this man likes the Hereford, and either one of them are good, so good it

doesn't make any difference which you have got, if you have good ones of either, or black cattle, if you are raising beef cattle, and if raising dairy cattle confine yourself to the dairy breed. Now, I want to call your attention to one fact,—that in the state of Texas in ten years the average increase in weight of the four-year-old steers that have been placed on the markets at the packing centers has been two hundred pounds. No state in the union has bought so many pure-bred bulls in the last ten years as the state of Texas; they have bought them by five thousand in a year, right in the corn belt; they have gone to the Riverside Farm at Ashland, Nebraska, and have taken a whole stable at an average price of \$333 a head. Out in this country we have a different class of men. One of our largest stockmen in Jefferson county told me he never saw a bull he would give over a hundred dollars for; that he did not believe—and he did not, he was sincere—he did not believe an average rancher could afford to pay much more than that. The result was that two years ago the Bear Paw pool and Milk River pool—John T. Murphy and other men—who had for years been buying his steers—absolutely refused to look at them. They had been inbred and no new blood was added, until they were absolutely a drug on the steer market; and two years ago was a good steer market, we all know that. Now gentlemen, the trouble with Montana in our stock business is this, that we have got too many “canners”. If this war had not broken out, I don't know what we would have done with all the canners we have got. We have too large a proportion of canners, and too small a proportion of prime beef. That has been one trouble with the cattle situation in the last year. In Chicago, in the month of December, I was in the stock yards, and there was a great run on cattle just before the International Stock Show—there always is; you can see the two extremes of the world in the month of December in the Chicago stock yard; you can see the poorest cattle the range ever produced and see the finest cattle the world has ever produced; you can see them all there in one week. I saw western cattle there, saw cattle from Montana that were not a credit to the state; and the proportion of absolutely good cattle that were there from our range country was not representative. We have reached the point now where our farmers can raise feed, you can raise alfalfa and you can raise clover, and you can feed it to good blood and you can make more money on your plant in propor-

tion than you have been making on your neglected and wide-open range; and I guarantee that you can do it. This range fight is a good deal of poppy-cock; it is a good deal imaginary. Now every sensible hard-headed man in this crowd knows that we have not got any range anywhere; we have never raised any range; we have fed it as short as we could feed it and taken every bit that is to be taken off it every year, and the fact is the range, by the over-stocking, is gone, and if the country was still as open as it ever was, it would not be what the old timers tell you that it used to be. It has simply been fed off, and there has been no system of re-seeding and no care of the range, and the result of a natural climax to years of neglect of the public range, both the range and the stock is deteriorating rapidly.

Why should a man devote four years to the raising of a twelve hundred pound steer when he can produce a better steer in two years? Why should he take \$3.25 per 100 lbs for a four-year-old steer as a "canner", when he can put that steer on the market at two as prime beef? Now you have got a place here where there is a fair proportion of range to each cultivated farm. You are coming to the point, gentlemen, where, as the tide of immigration comes along, you will own a certain proportion of farm land, and a certain proportion of pasture land. Now, you will do one of two things. You will either husband that pasture land, fence it, let it rest, re-seed it, reclaim it in some way or other, or you will proceed to try to follow up the lines that have been in custom here for so many years. But if you reduce your band of cattle to the point where you can take good care of them, where you have got pasture land enough to see them grow all the time; if you will reduce them to such a point and add good blood, build and improve them in the same proportion that you reduce in quantity, you will produce just as much in dollars and cents in beef; yes, more than you have ever done before.

Now, take the situation as it is today. This war has broken out and I read in the paper yesterday that pretty soon the Japanese horse buyers will be in here to see us; will be in here to buy horses for the cavalry; we haven't got them; we have got a lot of horses that can carry a small Jap, but if we happened to get a very big Jap on it, he is not going far. We sold all the big horses we had to the Boers and British, and then we did not near supply the demand. The inspectors of the English army took horses that were a half a hand below the army regulations.

Now that year we sold those horses—we sold seventy thousand of them—and what do you think we got for them? We got less than fifteen dollars a head; for the entire year the average price of the horses we sold was less than fifteen dollars a head. We had inbred and inbred and inbred; we had just turned them loose on the range and they had inbred naturally until they were “wattle-heads” like oxen. The state of Montana lost a million dollars that year when the horse market was good; it lost a million dollars in the difference between the price of a fair average horse and that they got. Now, how many stallions will a million dollars buy? Five hundred thousand dollars will buy you all you want in the state of Montana.

Here is another thing which I learned about in Chicago this winter. Orders for export horses by buyers at the Chicago stock-yards, for horses of 1200 pounds and over have not been filled by nearly sixty per cent; the horses were not on the market in Chicago. The class of horses from 1500 pounds up, there were less than fifty per cent of the export orders that could be filled out of the Chicago market alone. Now, that shows you where the horse business is in this country. I would like to know, gentlemen, out of curiosity, where an army buyer for the Japanese army would pick up artillery horses in Montana; he wouldn't find them; we are not able in the state of Montana at the present time to produce a sufficient number of twelve, fourteen, fifteen and sixteen hundred pound horses to supply the home demand by a great deal, and I want to tell you that Montana can produce absolutely, with good blood and good care and good feed, it can produce the best horse on the earth today. There is not a question about it. But from this promiscuous breeding we are losing hundreds and thousands of dollars—that is, we are not losing it because we never had it—but we are losing an opportunity to make it and to add it to our farm returns. This is a serious question. The farmers of Montana must change their line of work; the stock breeder must certainly do so. You haven't any idea, gentlemen, of the change in the business situation that the feeding of sheep and cattle has brought about in the Gallatin and Yellowstone valley. In Billings, for instance, there used to be money but twice a year, once when the steers were shipped and the other time when the wool went. In the feed lots of the Yellowstone valley this winter there have been some two hundred and fifty thousand sheep; Mr.

I. D. O'Donnell fed twenty-five thousand sheep successfully. Those feed lots are increasing all over the Yellowstone and Gallatin counties. Here in Cascade I find one bunch of five hundred steers on feed, and the estimate of the figures that the gentleman is keeping, the record he is keeping, indicates that he is going to make a profit on his hay. But the town of Billings, the town of Bozeman, through this clover, alfalfa and winter feeding of stock, are two of the best towns we have got in the state; they are going right ahead. The business people have appreciated the advantages of this stock feeding association, and there is no business man in Billings or Bozeman today but will tell you that the feeding of livestock in those two valleys has added more to the prosperity, to the value of the land, and to the betterment of the general business and farming condition than any other thing. It is going to be so with you; but you must feed your stuff to good blood; don't feed it to scrubs; there is no profit in that. A man up here the other day said to me "I have got some Jersey cows, and I am thinking of crossing them with Holsteins", and he said, "What do you think about it?" He said, "I am selling milk, and the Jerseys do not give a great deal of it, but it is rich", and he said, "crossing with Holsteins would give more milk; it would reduce the richness but add to the quantity. What do you think of it?" I said, "Well, what is the matter with buying a pump?" He could buy a pump and reduce this Jersey milk to the consistency that the milkman wants cheaper than by mixing up his breed. Don't mix your breeds. As an abstract proposition, I would advise every man who has a bunch of cows to go through them carefully, look them over, see whether you have any that are not going to pay for their feed, and if you have, get rid of them at any price. If you have got enough cattle to justify buying a good sire, go and buy one; pick out a good one and pay the price. There is no money in a cheap sire at the head of your herd, not a dollar. If he suits you, he is worth what the man asks for him, and if he doesn't suit you, don't buy him at any price. Let every farmer go through his cattle, see what he has got, shape up his herd, buy a good sire and start in on a good line, and I can guarantee you, if you do this and give your feed to good blood, you will make more money from it than you will to feed it to scrubs. I never saw a man yet who could feed a scrub profitably; that is, there may be men who can do it, but I have never seen it done; at

least as profitably as the same amount of feed given to well bred cattle. At the present time the feeder has received the profit on your cattle; he has gotten as much for feeding your cattle seven months as you have gotten in four years for raising it. In many cases he has got just as much money. With the opportunities we have in almost every valley in Montana for growing alfalfa, clover and other forage crops, and roots, if you feed these crops to good cattle, and reseed your pasture lands, preserve them, build them up and let them rest occasionally, I believe, gentlemen, you will add thousands of dollars to the wealth of your community and you will add prosperity to yourself. I want every man to sit down and think about this question of bettering the blood in his herd, give it attention, because if you go around the cattle a little as I have gone, it will impress itself on your mind that you can't progress with haphazard breeding; there is no profit in it. Traveling around the state as we have, you can see the opportunities Montana offers with its wonderfully nutritious feed. Its magnificent yields of clover and alfalfa will impress on your mind the thought that you should improve your opportunities by giving some attention to livestock improvement. You must bring your operations around to face the new conditions which are coming as inevitably as we are here.

THE FEEDING OF SHEEP.

Prof. W. E. Harmon, Bozeman, Mont.

The system of farming in the Gallatin in the past ten years has undergone a great change. This change has been brought mainly through the experiments in feeding sheep and cattle by the experiment station at Bozeman. For many years grain has been the principal crop of the farmer, and to get satisfactory yields summer fallowing had to be resorted to. After a time the soil under this system began to show loss of fertility and the farmer began to investigate. Clover rotation was found to be the solution to the problem. Finer clover cannot be grown anywhere. Where but few raised clover, a ready market could be found for it, but when a majority of the farmers began to grow it, its disposition became a serious question. Few farmers have cattle enough to consume the hay, and many having no cattle

were obliged to find a market or make one. The writer finding himself with a large quantity of clover hay and no market, concluded to try fattening sheep. The business of sheep feeding being an untried experiment, few sheep were bought, and these were old ewes. The net loss on the venture was \$750. This was a costly lesson, but something was learned about the business. The ewes were old, and many of them locoed, and would have been dear at any price. Next lambs were purchased for the winter's feeding. There were fourteen hundred and seventy-five of them and they cost \$1.60 each. They proved a better investment and gave a return of 90c for the grain fed them and \$11 per ton for their hay.

Many things of interest were learned in this feeding experiment. The first was, poor lambs have no place in the feeder's yards; second, locoed lambs are of no value as feeders, there being in this band nearly two hundred touched with loco. There is no safety in purchasing sheep in a country or locality where loco abounds. This is the experience of buyers the country over.

The past season has been one of interest to those who have fed sheep in Gallatin valley. There have been more than 50,000 sheep fed. With the cattle that have been fed it is estimated that fully 12,000 tons of hay have thus been used. It is pertinent to remark in passing that clover hay would have had very little value this winter if no stock had been fed. It has enabled many to dispose of their crop at a good figure and thus has this been the source of many a dollar to the farmer.

Sheep feeding has its ups and downs. No one can predict what the market is going to be when his sheep reaches the market. The Colorado sheep feeders after enjoying several years of good prices, suddenly sustained a loss of one million dollars, in 1901. This again seems to be an "off" year on the Chicago market. But what of the future? Shall we go back to grain farming? It is not to be thought of. If a bad year comes to us in the raising of grain we do not all quit and wait for prices to suit us, but we put in our next crop hoping for the best. Many that have fed sheep this winter in this valley have not found it a profitable business, yet they are not discouraged. As some of them have said, "I am going to try it again, I know where I missed it".

In our experience with a band that has just been marketed at

top prices in Chicago, we have many interesting facts. The band consisted of 1,200 lambs; 1,000 of them were purchased in Beaverhead county by Mr. John Robinson. They cost \$2.05 a head on the ranch. They were brought to the ranch October 8 and averaged 63 pounds. They were given the range of the entire farm of 160 acres. The farm had 63 acres of grain stubble and 65 acres of clover stubble, the second crop of clover having been cut and stacked. These lambs were weighed again after having been on the fields twelve days and showed a gain of 4,000 pounds; ten days later they were again weighed and showed a further gain of 2,500 pounds. At this time 200 more lambs were purchased that weighed 55 pounds average. The two bands were put together. Twelve days later the band was again weighed and to the surprise of all, showed a loss of 1,200 pounds. The pasture had become exhausted evidently, although the lambs seemed to be doing well.

No feeder can afford to be without a hay scale. Without the scale no one would have ever known that these lambs had lost weight. The lambs were placed in the feed yard November 8 and two and one-half pounds of clover hay fed to each daily. The lambs were fed in one band until December 22, when 100 of the smallest were put by themselves and given extra feed and care. The band of lambs before this would eat but two and one-half pounds of hay each per day and then not eat up the stems of clover. After a short time the hay ration was increased to three pounds per lamb and every bit of it was eaten. The lambs were given a light grain ration of oats and wheat December 5, one-third being oats and two-thirds wheat. The lambs soon received one-half pound per day. In twenty days they were on full feed of three-fourths of a pound per day and were fed this ration for 60 days. The lambs had eaten 50 pounds of grain each when they were sold, February 20, and 175 tons of clover hay for the entire band. Much of the hay was wet and badly damaged, yet the lambs made no objection to it; cleaning out their racks daily. They were fed both hay and grain twice a day and had all the well water they needed, the water being pumped with a Fairbanks-Morse gasoline engine.

An interesting part of this feeding experience was the comparison between the large and small lambs. The large lambs were grade Shropshire and Rambouillet, the Shropshire predominating; the small lambs were a Delaine and Cotswold presuma-

bly. In the last 60 days of the feeding period the small lambs were fed a little more than three-fourths of a pound of grain each and all the clover they could eat and gained 13.1 pounds, while the large lambs were fed a little less grain and all the hay they could eat and gained 16.9 pounds. The large lambs when sold weighed 93.4 pounds, while the small ones weighed 72.4 pounds.

When we take into consideration the fact that there is a difference of more than a dollar per hundred in Chicago in favor of the heavy lambs, it will be seen that small lambs are a losing proposition all around.

This band of lambs paid all expenses, interest, and pasture and gave a return of one dollar per hundred for grain and seven dollars per ton for the hay fed.

Reflections over these three years' experience force one to conclude that there are a great many things yet to learn about the business. The buying would be somewhat simplified if sheep were bought by weight. There are so many conditions that may arise that it is almost impossible for one to buy a lamb for what he is worth. The range man when shipping east must sell by weight and it is a noticeable fact that they seldom net the shipper what he asks the feeder here for the stock. The eastern feeder goes to the market, buys the stock shrunken, and by weight, and at once has the advantage of the western feeder. It is a mistake to buy stock too early with the idea of running it on pasture for cheapness. A feeder in the state bought 18,000 head of sheep that lost seven pounds each on cheap pasture. It is a costly error.

The mutton types of sheep are in every way superior to the wool types as feeders; and small runty lambs cannot be fed at any price. The high market price of sheep in 1903 made the range man think that he was not getting his share of the profits from the sheep industry. Hence this year all stock has been held fully twenty-five cents too high, thus making it a close proposition to come out even with the Chicago market, nearly \$1.50 per hundred lower than one year ago.

The coming fall ought to bring a reduction in the cost of range stock or feeders will let their hay remain in the stack until such a time as it can be fed with profit.

A prominent feeder says the Gallatin valley is superior to any feeding section he has ever visited. The hay is the best and

grain for fattening purposes at your very door. If you don't make a great success financially, I believe it is your own fault.

The benefit accruing to the land by handling sheep is no small item. The manure from the feed yards can be used for dams in the irrigating ditches in the meadows and the manure hauled on the sloughs thus, increasing the yield of timothy or clover. The summer fallow method has had its day. Clover has come to stay.

Feeding must be studied carefully in all its details. Good stock must be fed and "finished". It takes about 300 pounds of hay to fatten a lamb and 50 pounds of grain. The lambs should make an average daily gain of a little more than one-fourth of a pound. A lamb to command a good price on the Chicago market, should leave Bozeman weighing around 90 pounds and should be "finished". Nearly 10 per cent will be lost in weight in shipping, leaving about 81 or 82 pounds in Chicago. From this it will be seen that a lamb should weigh 65 pounds when he goes into the feed yard. A small number is best to begin with. The business can be enlarged as experience is gained. It has been argued that large bands cannot be fed so successfully as very small bands. The experiment station in its work showed that an average daily gain of one-fourth of a pound per lamb could be made. Mr. John Robinson, Mr. Harry Smith, Mr. E. B. Lamme and the writer have done even better than that with large bands. This holds true in sheep and lambs of good feeding types. After a sheep has been "finished" these gains can no longer be obtained. A band of yearling wethers that gained ten pounds per month until fat made but four pounds gain the last month. A lamb, however, will still grow and give better returns to the very end of the feeding period.

The feeding pens should be on dry land, provided with plenty of pure water, protected and sheltered from wind and storms. The sheep should be confined in as small space as is convenient for feeding purposes. They should be fed regularly and disturbed as little as possible. The sheep dog should keep out of the corral and strangers often disturb a band greatly.

These points seem trivial. A loss of one pound on a single sheep is small, but on 3,000 sheep it is no small matter. In the feeding of hay and grain there is a difference of opinion. Some argue that the hay and grain should be fed together, so that the grain cannot be eaten too rapidly. It has not yet been proved

conclusively whether it is better to feed separately, or together. In the matter of watering about sixty feet per thousand seems necessary. It has been noticed that a sheep failing to get water when he wants it, may not try to get it again for one or more days.

DISCUSSION AT DILLON.

Mr. Robinson, have you ever tried feeding hay alone?

Mr. Robinson: I have fed some lambs with but very little grain.

Q. I mean older sheep?

Mr. Robinson: I fed a lot of two-year-old wethers. I fed about 2000 first on pasture, then on hay, for about 60 days and sold them to a Seattle buyer, and he didn't cut out a single one.

Mr. Landon: The natural conditions could not be better in any part of the state for raising hay than they are in Beaverhead county, and I think just as fine hay is raised here as anywhere if it is properly put up. I was over around Bozeman and I couldn't see that the hay was any better or contained any more nutriment than it does here. To my knowledge I thought it could not compare to the second growth of hay that is cut in Beaverhead county. Of course I may be mistaken. And I want to state in regard to those lambs that were sent over there from here: Those lambs were a fair average of the lambs raised in Beaverhead county. When they had taken that long drive from here to the Gallatin valley a person who had seen them before would hardly have known them to be the same. Another thing, there isn't a single case of loco in this county. If there was a case among those lambs it must have been caught on the road. There is another thing that we ranchmen are free from and that is scab; every sheep man is a graduate in scab, and there is no disease at all amongst the sheep in this valley; not many localities can claim that. My experience in selling sheep to buyers is that they always want to buy by the head instead of by the pound, but I believe right today that when the farmers take into consideration the money that is in the sheep business by feeding, they will make double out of their hay, and sheep raisers will find a market at home for their feed. If there is no one to feed lambs next year, and if I can buy hay and grain, I will try the experiment.

Q. I would like to ask, when you fed exclusively on hay, did

you have any statistics as to what they consumed?

A. The wethers, that is, the two-year-olds, will consume four pounds, the yearlings three and one-half pounds.

Q. How long did you feed those wethers and what was the gain?

A. That was another band; I believe I fed them about 60 days and they gained about 20 pounds. I had no scales right at hand then.

Q. On $4\frac{1}{2}$ pounds of hay a day?

A. Yes.

Mr. Nelson: It seems to me that the hay must be better quality if you can fatten on 4 or $4\frac{1}{2}$ pounds a day. From my experience I have fed about 5 pounds of hay and it don't fatten them, if I give them as much as they want it usually fattens them, even 5 pounds a day won't fatten mutton sheep.

Q. Do you think it is better to finish the animal at home than to ship to St. Paul and feed it grain? It certainly does from our experience during the last few years in feeding.

Mr. Robinson: We don't realize when we have a finished animal for the market, while its flesh may look fair and reasonably fat, it is not ready; the flesh will often shrink too much. In every case where we have shipped finished stock from the Gallatin we have topped the market. The most economical way of shipping sheep is to finish them before taking them on the journey and when you arrive at your destination hold them there for five or ten days and get the best hay and feed you can, and fill them up so you can make up shrinkage. You can select your hay and grain and pick out a number of the band every day for market. That is the course generally pursued.

Q. What did finished lambs bring a head this year (1904) in the Gallatin valley?

Mr. Robinson: About \$4.25; but many couldn't sell for \$4; those that brought the good prices were finished, the others were not finished and some were of poor breeding.

Q. Don't you think a feed of oats would be as good as a feed of barley?

Mr. Robinson: The Experimental Station tried giving the straight grain and then tried giving a mixture and they found they got better results from the mixture. They tried screenings from the mill and they obtained fine results from them.

Q. Wouldn't the screenings be about the same as chopping up the grain?

Mr. Robinson: No, I don't think it would ever pay to chop grain for sheep.

Q. How long is it necessary to feed before shipping and what is the best way?

Mr. Robinson: There is a difference of opinion on that. Some think it is best to begin the grain on a small ration and continue through the entire feeding season with hay; our custom has been to feed about one month on hay and then to feed grain; thirty-five days of hay and thirty-five days of grain will finish the animal fairly well.

Q. That is from 60 to 80 days before shipping?

Mr. Robinson: I will say this, that if we can sell at home for anything reasonable we much prefer it to shipping. I shipped a number of sheep and sold them at St. Paul for \$5.50 and I figured that I made money by it, even more than if I had taken them through and sold them for six cents a pound.

Mr. W. Crowell: I would like to ask a question in regard to this disease loco; I don't know exactly its effect on the sheep. How is the animal affected, and does it ever outgrow it?

Mr. Robinson: The lambs often become affected after running on the range for two or three months. It is very noticeable; by examining the sheep you will find that its teeth easily separate, and it holds up its head as if it could not see well. You find on feeding whole grain that instead of fattening it begins to lose. It will affect sheep when they are two years old as well as yearlings. The only way to get rid of loco is to get out of the affected district and get rid of the diseased sheep.

Q. Then you think on the whole it pays to feed lambs?

Mr. Robinson: Yes, I think it pays.

Q. Do you think it is more profitable to feed sheep than cattle?

Mr. Robinson: Yes, I do.

SHEEP RAISING.

Frank Landon, Dillon Mont.

This is a subject that I am not fully prepared to discuss and I thought I made some arrangements to get out of it.

I have had considerable experience in sheep raising for a number of years and I think Beaverhead county is one of the best counties in Montana for sheep raising, if not the best.

In the year 1869 our fellow townsmen John F. Bishop and R. A. Reynolds brought into the county the first sheep that were ever brought into the state of Montana. I believe that later Mr. Poindexter and Mr. Carr brought in sheep. I have had considerable experience in the sheep business and have met with reverses and have made money. I will say that the sheep industry today is not like it was in the early 70's. At that time all a fellow had to do was to get a band of sheep; there was plenty of free range and there was no expense like there is today. You only required a few men during the lambing season; but it is different today.

From the day the first sheep were brought into this valley sheep raising has been one of Beaverhead county's most prosperous industries. From the year 1869 until the early 80's or the middle of the 80's, say about 1885, I do not remember of having seen a band of sheep fed; now it is necessary to feed hay, and today I believe the greatest menace to sheep raising is the Forest Reserve, far greater than the Wilson bill ever dared to be. If the forest reserves are to rule then a man might as well go out of the sheep business if he has not the facilities for feeding.

The question of sheep raising has been discussed time and time again, and I have never heard it discussed but what I got some benefit from the discussion, and I think it is so with all of us. About a year ago the question was talked over here as to what class of sheep was most suitable for Beaverhead county, and a paper was read advocating the Merino sheep, but I do not feel that this is the most suitable sheep for Montana; they are not as hardy as the black faced downs and the breeds of coarse wool sheep. I shipped some sheep to Omaha and I separated the Merinos from the other sheep and everybody wanted to buy the other sheep. Last fall I took a band of Merinos over to Bozeman and a band of the black faces, and the black faces were pointed out as the best sheep, although there was seem-

ingly very little difference between them. Now I am not prejudiced against the Merino, on the contrary the best range sheep must have some Merino in them, but not too much, they are hardier and will stand the climate better. I have sold my sheep, with the exception of those that have a little too much Merino in them. Now from my own experience the hardier sheep are the best sheep for the western markets; that is, Seattle and California, and the hardier sheep must have some Merino in them, but we must be careful that they do not get too much Merino. When we ship sheep we are largely at the mercy of the commission man. For instance, I went to Omaha with a band of sheep and sold them at 4 cents a pound; the man who bought them paid 4 cents and borrowed the money to buy them with from the commission man. In that case the commission man was receiving a percentage for selling the sheep and interest off the money. Now there are a great many "knockers" around the country who do a great deal of harm to the sheep business. A knocker is a fellow who, if he knows of any new enterprise, tries to down it. For instance, a man was buying sheep and I asked him to come and look at my sheep, and he said he did not care to, as they were too poor. I asked him if he had ever seen my sheep and he said he had not but that Mr. So and So had told him about them. If one of these fellows sees a man who has bought a band of sheep he will most likely say, "there goes a fellow with a \$2,000 loss". A "knocker" would down any enterprise.

In raising lambs we have always made it a point to corral our lambs every night for the first month. This, I found, is a hindrance to the lambs, as many of them lose their mothers, and it takes them hours to find them again and some never do find them. From my experience I think it is better to leave the lambs with their mothers and they are much better sheep when shearing time and selling time comes. Another critical time in the lamb's life is the last months it runs with its mother, say in the months of September, October and November; the ewes do not give much milk and the conditions are not favorable to the growth of the lamb; still we do not notice the change and say, "we will let them run a little longer", and the result is the lambs fall off a great deal. Could we not adopt some plan to keep our lambs from falling off during those months; the month before we go to sell? The time is coming when we are going to sell

our lambs by weight and then it is going to pay to feed them. We have never had a practical feeder in Beaverhead county, but I believe in the course of a year or two there will be some practical man take hold of this thing and find it more profitable to raise hay and grain for that purpose than to ship, and we will have markets right at home for our sheep and more buyers will come into Beaverhead county than ever before just as they go into the Big Hole country to buy cattle, because they fed them.

Beaverhead county is as fine a place for sheep raising as any section in Montana, the hay and grain raised here are as fine as any you could find elsewhere. Of course we cannot compete with Bozeman on the Seattle market, but we beat them when it comes to the California market. Beaverhead county has the reputation of raising as fine sheep as any other section of Montana, and I think the time is not far off when the county will have as good a reputation for feeding and selling, and the farmers will find out that it will pay better to feed their hay and grain than to keep it for the market. That is the time I am sure that we would all like to see.

DISCUSSION.

Mr. Featherly: I have not had any actual experience in sheep raising, but I have been feeding a bunch of sheep for Mr. Landon, and I find that the black faced fatten up much quicker than any other sheep in the bunch. That is all I know, but I wish somebody else would give us their experience.

Mr. Robinson: It has been my experience in feeding to find that the coarse wool sheep fatten quicker and sell better than any other sheep. From my experience in shipping I find that the coarse wool sheep always top the market, and such has been the experience of every feeder in the Gallatin. The coarse wool sheep stand the trip better and do not show the wrinkles like those of the finer wool.

Dairying.

WHAT IS SUCCESSFUL DAIRYING AND HOW ATTAINED.

W. O. Parker, Billings.

The first part of this question is easily answered. It is where the product of the dairy, whether it be milk, cream, butter or cheese, sells for enough more than it costs to have a good profit. This is the rule men engaged in other business apply as well as farmers should apply, especially if we are to engage in dairying as a business.

I wish before discussing the last part of the question (and how attained) to speak briefly on dairy conditions in our state. In a table prepared by C. H. Edwards, secretary of the State Board of Horticulture, it is shown that in the year 1901 there was shipped into this state 4,356,956 lbs. of butter and 751,366 lbs. of cheese. Now let us figure a little. Had this butter been made here at 20c per lb. it would be \$871,391.20. The cheese at 12c per lb. would be \$80,163.92, making for butter and cheese alone \$951,555.12. I believe that if this butter and cheese was made in any state in the union at a profit it could be made in our own state with its climatic conditions and the large amount of forage its cultivated acres produce and that of the very best kind for dairy production.

Returning to the question (and how attained), first, I will take the man. He must be possessed with energy, perseverance and a large amount of the grace of patience. He must study the conditions which surround him and take a deep interest in all the details, from the selection of the cow to the finishing and marketing the product. He must keep in touch with advanced ideas of feeding and care of cows and adopt such as are to his advantage, although they may not accord with what has been his own, or those of his ancestors.

With the kind of a man described there need be no further discussion of this question for such an one will bring about all

the conditions to attain success. But there may be some who have the natural requisites for successful dairying who lack experience, so I will briefly take up the cow and its care. I believe the dual purpose cow to be the best in our state at the present time and in my experience it has not been hard to find good dairy cows although particular attention has not been given to breeding for the dairy. A cow to be profitable in the dairy must possess three qualifications: quantity, quality of milk, and persistency of milking. How can we get this class of cows? My answer is by the weeding out process, and this is a very important matter in attaining success. The man that is satisfied without knowing what each individual cow is doing is not the one who is to make the greatest success. First: Set a standard we will say not less than 5000 or 6000 lbs. of 4 per cent milk for each cow for a year. Weigh each cow's milk one day each week and make a record and at the end of the year you can very nearly tell the amount each cow has given. If making butter, use a tester occasionally to determine the amount of butter fat the milk contains and you will know what each individual cow is doing. Dispose of all that don't come up to your standard and fill their places with others and in time you will have a dairy herd of which every one is paying a profit. This seems a great amount of work, but it will give greater returns than any other work you can do for you can't afford to keep a cow that is just paying her board and perhaps worse, eating up the profits of a good one.

THE CARE OF THE DAIRY.

Have a time to do everything and do everything on time; a time to feed, a time to water, a time to milk, a time to churn, and a time to market the product. Don't think some other time will do just as well. Don't let this noble animal, the dairy cow, that is so ready to do her part toward success (if you will do your part) stand humped up in the cold wind with nothing but a barbed wire fence for protection. Don't let her lie in filth and eat unwholesome food and drink filthy water, but rather give her a balanced ration of good foods and plenty of good water to drink, good shelter and bedding, and see how soon she responds with an increase in the profits for which you are seeking.

For best results in obtaining the cream, I prefer the separator,

though good results can be had in other ways, even going back to the old way of shallow pans. The quality of the product will depend much on the skill of the one that handles it and an excellent article can be made from milk set in the old fashioned way. While accumulating cream enough for a churning keep it at a cool, even temperature, stirring thoroughly when fresh cream is added so it will ripen evenly. When ready for churning have cream at a temperature so the churning can be done in 25 to 35 minutes, say from 60 to 68 degrees Fahrenheit, according to conditions. Work once, salt to suit your customers, put up in an attractive way and deliver to the customer soon after made. Deliver at the time agreed upon as this has much to do with holding a customer. Should there be criticism let the grace of patience have full sway and try and learn where you can improve.

SELL THE HAY AND GRAIN TO THE COW.

Prof. W. J. Elliott, Agricultural College, Bozeman.

I want for a short time today to throw out a few suggestions along the lines of getting more out of the feed which we are growing so plentifully in Montana. The farm of the future in Montana will be of smaller acreage than that of the past. We are no longer permitted the unlimited ranges for our stock over these fertile valleys and bench lands of the state, because our eastern friends have come here, and have come to stay. Thus the arable land is not only being fenced but is being cut up into smaller farms to make room for the ever increasing demand for homes for our incoming neighbors. Hence, we say the farms will be smaller, and not only that, but the herds of cattle will be much smaller because there is not the extensive ranges of a few years ago. Now this tendency to smaller farms and smaller bands of cattle will have a beneficial result in two ways, viz: our farms will be better cared for and thus produce better crops per acre, and the quality and money value of our stock will be very much increased. The tendency of the new system will be to make more money off of fewer acres with less work.

Now to sell the raw materials, such as the grains and grasses on the market is an expensive practice for the farmer; first, because of the labor to get the produce to market; and second, because of the unsatisfactory prices of this raw material. As a

general thing it pays much better to deliver the feeds to the market in the concentrated form or as the finished article, because it is much easier to deliver the finished article as butter, cheese, beef or mutton or pork. Besides, in the feeding of such products a great deal of the fertilizing value of the crops is returned to the land as manure, which by selling the hays and grains is removed from the farm.

Now the dairy side of this feeding question is that about which we wish to speak particularly at this time. I firmly believe that by feeding our grains and hays to some good dairy cows that we can make \$2.00 for every \$1.00 that we can make by selling those feeds on the market. We have one cow at the station at Bozeman that during the past year paid us over \$3.50 for every one dollar's worth of feed we gave her. It cost us \$30.00 to feed her for the year and she made 236 lbs. of butter which at 25c per lb. makes \$94.45, and figuring the 8218 lbs. of skim milk at 15c per hundred pounds, we get as a total income from the cow \$106.75. This amount does not include the calf. However, she is an exceptionally fine milk producer. The average of the Station herd will not be as great as this, but they will bring us from \$30.00 to \$75.00, or an average of about \$60.00 per cow per year.

Now these cows at the Station are not especially bred or high class dairy stock, but are simply an average herd of grade cows that were purchases from farmers of Gallatin valley. In fact they were selected with the special object in view of showing what can be done by careful feeding and management with an ordinary herd of grade stock such as any farmer in Montana can easily obtain.

Of course our first herd contained a number of animals that did not even pay for their keep. These were sold and replaced by animals which we thought would give better returns, so that this year we start in with a herd of about 25 grade cows, most of which are fairly good milkers. With this herd we are endeavoring to find whether our claim that an average herd of grade cows at the present prices received for butter and cheese will pay \$2.00 for every one dollar's worth of feed given them. All the hay and grain is charged to the cows at market prices.

We need not fear in the least overstocking the Montana market with the butter and cheese made in our own factories, for last year Montana imported over \$1,000,000.00 worth of butter and cheese and 7,000,000 lbs. of oleomargarine. This amount of

butter and cheese manufactured in our own state would keep 100 creameries, each receiving 5000 lbs. of milk per day, or 75 cheese factories, each receiving 3000 lbs. per day, going for 12 months of the year, and would be infinitely better for the state, as the one or two million dollars would go into the pockets of the farmers of our own state instead of into the pockets of the farmers of other states.

We have made a good start along dairy lines in Montana, having at the present time some 10 to 12 creameries and 4 or 5 cheese factories in operation; eight of these having been built during the year 1904. Some of these creameries we are afraid are a little premature, as one of the farmers told us in speaking of a creamery that had been built in his town by a promoter, that he didn't think they could get 100 cows to supply milk to that factory within 10 miles around. This is very unfortunate because no creamery can be run as a success without at least the milk from 300 cows.

DISCUSSION ON DAIRYING.

Ques. How much would it cost to build a creamery?

A. J. Elliott: In Montana a creamery capable of manufacturing the milk from 500 cows can be built for \$4,500.00. That will put up the plant complete and up-to-date in every respect.

Q. Do you like the hand separator?

Ans. Yes, I think for the farmer they are the thing. You can draw the cream from more milk to the factory, and besides you have the skim milk for the calves at the very time that it is sweet and in the best condition.

Q. Hand separator men say that a separator will pay for itself by the extra cream it takes out of the milk. Is that so?

A. Yes, with 10 cows a \$100.00 separator will pay for itself in from one to two years due to the extra butter obtained.

Q. When you skim by hand even if you can't skim so close, the calf will get what butter fat is left in the milk.

A. Yes, that may be so, but I think you can feed a calf cheaper than by feeding the butter-fat especially if that fat is worth 25 cents per pound.

Q. How does barley fed with alfalfa do for dairy stock?

A. Those feeds would make an excellent combination. It

might perhaps suit some a little better if there were a little crushed oats in the mixture.

Q. What breed of cattle would you recommend for a dairy herd?

A. In my opinion that is a point to be settled largely by the individual, himself. Successful dairymen in this country do not all handle the same breeds of cattle. It is not so much a question of breed as it is the care and management they receive. I would not advise a man who has never handled finely bred stock to invest in them. Rather start with the ordinary grade cows which you have, then as experience in handling dairy stock teaches you, you may perhaps handle strictly dairy stock of high quality and breeding. Always, however, use a pure bred bull to head the herd and if milk production is the sole aim get a bull descended from stock strong in dairy lines.

D. E. Bandmann: I would like to ask the gentlemen here how many there are here who have cows that produce as much as 300 to 350 pounds of butter a year. I would like to say that I know something about cows myself. I would be very glad to know some of you who produce even an average of 300 lbs. a year. Every one of you are very fortunate I assure you. There is one thing I do not quite agree with; I have done that to my great loss. I think the first thing before you get the cows is the preparation of the land, and that is where the great value of alfalfa and clover comes in. If you put your land into clover and alfalfa I don't see how you can help to be the most independent farmers in the state of Montana.

Q. I would like to ask Mr. Ingalls if he has got the figures in regard to what his cows have produced within the past year?

A. I had twenty cows last year, I think, and got 7600 lbs. of milk from each cow. I had one cow that averaged 11,000 lbs.

Mr. Bandmann: Mr. Chairman, is it in order to bring up a question over which the farmers are very much worried in this section, and that is, the introduction of oleomargarine. The reason why he is not encouraged more to make butter, is that the consumption of butterine is almost one-half, as much, even, as two-thirds, of that of butter. We are not encouraged to make butter on account of the prices. We are very much injured by the sale of oleomargarine, and I think it will be the duty of the farmer to watch this condition, as we shall certainly begin to do something in our part of the country to counteract it.

In Helena the first class hotels frequently use butterine instead of butter. How are we to prosper? How can we put our farms in the condition we have heard described, when we have to face the condition of 12 cents a pound for butterine, and that is the condition right here in Montana today.

Prof. Linfield: I don't think there will be any particular difficulty after a while, in regard to the sale of oleomargarine. Good butter when properly put up I do not think will be injured by the oleomargarine when the people know exactly what they are getting, and the ruling is made by the law, that it is to be sold for exactly what it is. I would like to ask if there is enough better produced in this valley (Flathead) to supply the valley with what it needs?

A. No, not half enough.

Prof. Linfield:

I don't presume there is a single valley in this state that produces enough butter to supply its own market. I cannot see for the life of me why, if the people in Minnesota and New York states can produce butter and make a profit, why we cannot, for they do not get as high a price for their butter as we do. I have never sold a load of hay in the east for less than \$8.00 a ton, or an average price of \$12.00 a ton, and I have produced butter and sold it at less than 20 cents a pound. And yet those people will swear by that dairy business more than anything else; you know that as well as I do. And if under those conditions that is true,—of course the labor price is not as high,—the milking is a little extra, but if you handle the cows in the proper way, I believe you will come to the conclusion as I have that there is profit in the business even on the basis I have stated, which is a very conservative one. I believe butter will average in Montana 25 cents a pound. The average cow will not produce 150 pounds of butter in a year; a great many not 100 lbs., because they are not the right kind of cows, and the people are not feeding them right. You have to keep a cow in good condition to obtain the best results. The market is all right if we had the right kind of a man and the right kind of a cow.

A Member: In regard to the price of butter, I do not think we need to worry about that. While I have not been in the dairy business here I have done something in that line as a side issue for the last six or seven years, and I find if you make butter,—now I want to be understood properly,—if you make **butter**,

not the stuff that is called butter, if you have a creamery properly managed, you can make contracts at 30 cents, and you need never sell at less than 25 cents. We can make contracts right here in the valley where you can place your butter the year around at 30 cents, if you are making the proper article; and when you get that price, and properly take care of your cows, there is something in it even at the price of feed prevailing here. I find the great trouble in dairying is to get the right man to handle the cows. You have to depend on hired help and in the West you cannot get them. I wanted to hire a man this fall to take charge of my herd of cows and had to send east to get him.

Q. I would like to ask if there is anyone making cheese for the market?

A. There is a firm in Stevensville making cheese. They are also making some little cheese at the Agricultural College.

Q. Do you know what is the amount of cured cheese per 100 lbs. of milk as they receive it there?

A. I do not know exactly what the test of the milk is; probably it is about 4 per cent, which would give close to 10 lbs. of cured cheese per 100 lbs. of milk. Three per cent milk would probably give $8\frac{1}{2}$ lbs. of cured cheese to 100 lbs. of milk. Say about 10 lbs. of cured cheese to 100 lbs. of milk, and we are selling cheese, the wholesale price, at 15 cents a pound. You can figure out the returns.

Remark: I find back East we figure $2\frac{1}{2}$ lbs. of cured cheese to one pound butter fat. Here I find the percentage of fat is low compared with Wisconsin. I don't know the cause of it.

Remark: It is not true in Utah. I believe it is because the cows are half starved in winter time. But under the right circumstances I believe you can make just as much cheese here from 100 lbs. of milk as you can in any place in the East.

A Member: Speaking about your hogs, what particular breed of hogs do you think develop the best?

A. My experience on that point, perhaps, is somewhat limited, but I find there is a greater difference in the strain than the breeds themselves.

Q. How would you feed pigs from the time they begin to feed from the trough.

A. Well, you have shorts, wheat, oats and barley. I use in conjunction with the milk feed a little shorts mixed with the

milk. Put it in the trough where the big hogs cannot get at it. Later add a little wheat to the shorts; wheat and barley later, or oats, but the oats contains considerable indigestible matter. I have not had much experience in feeding oats, for two or three reasons; oats were usually too high priced.

Q. Which do you consider best, to feed pigs cooked or uncooked wheat?

A. Uncooked, in every case. Prof. Henry of Wisconsin tried the most extensive experiments on that point, and he only had one experiment where the cooked food was of any advantage, and this cooked food he prepared just about as well as for his own table. Under those circumstances he got a little better gain from the cooked than from the uncooked food. But the uncooked grain gives, pound for pound, more increase in live weight than the cooked feed.

Q. Is it better to feed dry or mixed with water?

A. There is a great difference of opinion about that. For young hogs I have found that wet feed is a little better, but for a mature hog, I am not quite sure which is best. When it is wet a hog will eat more and gain faster, but when dry a little less feed is required.

Q. I am a new comer here and would like to know what to do with the pork. Is there any way to ship out of this country to Seattle and the Coast?

A. There is not, only by the Great Northern. Washington raises more pork than we do and ships it into this country instead of our shipping out.

Poultry.

POULTRY RAISING.

A. R. Currie, Bozeman, Mont.

In this enlightened age we owe much to science; and poultry breeders are no exception, as it has required both scientific and practical methods to bring the different varieties up to the present standard.

There are about 90 standards and a large number of promiscuous varieties of chickens raised in the United States. The classes number 11 and are divided up into varieties. I do not pretend to enter into all details, but would ask your attention while we look on the practical and economical side of the question and the most important things to be considered in raising poultry for profit and pleasure. A house for this climate should be warmly built, walls and ceiling should be double boarded and lined with paper. If the boards used in building are of good quality an air space between the walls is best, but if the material is poor, dry saw dust should be filled between the walls. Build your house facing the south if possible, and put it on a dry location so that the floor will not be damp at any time of the year. It should be built low as it will cost less and be warmer. The windows should face south and not be too large, as they let in too much cold.

Some authorities advise using an earth floor, but practical poultry men generally prefer a board floor, raised a little from the ground, as it is more easily cleaned and less apt to be damp.

A scratching shed in connection with a poultry house is of great value especially during the winter. It should be built adjoining the house facing the south and covered on the south side with muslin, which answers the purpose better than glass, it being better for ventilating purposes and a great deal cheaper. It need not be double boarded as it is merely a place for the fowls to scratch in during the day time. Let the floor be covered with straw chaff, or litter from 4 to 6 inches deep.

To build roosts in the house first construct a platform of the width and length desired, about 24 inches from the floor; at each end of the platform lay a cross piece of 2 by 4, and on these lay the roosts. The cross pieces and roosts should not be nailed to the platform as lice and knats are apt to get under them and are hard to drive out unless the roosts can easily be removed and disinfected. Furthermore, with movable roosts, the platform is more easily cleaned. In very cold weather a framework can be built above the roosts and covered with paper, with a curtain in front to drop at night; by this arrangement you can keep the finest stock and there will not be any frozen combs.

An ordinary box, such as canned goods come in, makes the best kind of a nest; all nests should be movable, so that there will be no place for vermin to hide in.

Stoves should never be used. Artificial heat makes the fowls weak and lazy and should only be used for young stock, and then only in a properly constructed brooder house.

The Kind of Fowls to Keep.

The different varieties of poultry have been so well developed during the last twenty years that almost all kinds are profitable.

But to confine ourselves to what is best fitted to our wants as a farming community, the barred Plymouth Rock is the most popular and most widely known and is often spoken of as the all round general purpose fowl of America. The origin of this valuable breed is somewhat obscure although its existence has scarcely reached the half century, but it is generally conceded that the oldfashioned Speckled Dominique, crossed with the Black Java, had much to do in its makeup and it is here to stay with us for all time. Its size is medium, easy to raise, quick growth and matures in about seven months, and it is a good layer of fair sized eggs, all of which makes it a favorite with the farmer.

Besides being a famous fowl, it is one of those most sought after by the fancier, which fact is always demonstrated by the large classes at the poultry shows.

As a table fowl it also comes to the front. As chicks can be got ready for the market in 12 weeks, they are easy to dress and present a nice, clean appearance. The pin feathers do not show as they do in black fowls, and this makes it altogether an ideal fowl when the housewife is buying chickens.

The Wyandotte is another of our American productions and we have seven different varieties, the latest being the partridge, which has the beautiful markings of the Partridge Cochins. They are a close second to the Plymouth Rock. They are also a general purpose fowl and very popular, as justly they should be. They are a pound lighter than the Plymouth Rock, but in characteristics much the same, as both breeds mature about the same time. For laying it would be hard to place the one above the other, and both are adapted to the raising of their own young, and each can claim the same term of general purpose fowl.

I would now turn your attention to the breeds that will outdo anything as egg producers. I refer to the Leghorns or Mediterranean classes, as they are called. There is likewise little early history connected with the Leghorns, but the Italian breeds have been known throughout Europe for many years, and are of much the same color as our Brown Leghorn. They doubtless are one and the same, but the American bird has been gradually improved by fanciers in their selections of the best, until we have arrived at a fixed standard. They are small and splendid foragers if at liberty; they will find the largest part of their living in summer time; their cost of keeping is less. They mature early; pullets have been known to lay when four months old. Their eggs are somewhat small, but what they lack in size they make up in quantity. Still, there are some breeders who claim they can outweigh the average Plymouth Rock. It has been my pleasure to see one lot of Buff Leghorn eggs tip the scale at seven eggs to the pound.

To anyone who wants eggs in winter and eggs only, nothing can equal the Leghorns; they require a house such as I have described. Of late years it has been a practice among fanciers to keep a record of the number of eggs each hen will lay, and it was ascertained by eastern men who make a business of raising eggs, that a flock of Leghorns, numbering 1,000 will lay 200 eggs a year, per hen. While this looks large, single instances have again and again been fully substantiated of individual hens laying 250 per year. I grant you this is an exception, but averaging the product at 25 cents a dozen, that hen's gross earnings were \$5.25.

The Rhode Island Reds, is the twentieth century fowl, bred from Plymouth Rock, Leghorn and Cochins, and is classed among our very best layers, being bred up for that purpose. There are

men who are making these things their study, and it is the selection of the best put to the best which again brings the desired result.

Men as a rule know how the speed of the horse has increased within their remembrance; and what passed in the days of our grandfathers would be perfectly ignored now. May not the same advancement be brought about in our feathered stock by those whose aim it is to have the best. Should not hens improve in production of eggs when there is a general advancement going on in all lines of industry? The farmer lifts his hat to the man who makes two stalks of corn grow where only one grew before. In like manner so do I, to the man who can make his hens produce twelve dozen eggs a year per hen, where before only eight dozen, perhaps, was a fair average. It is by no means going beyond the limit to expect twelve dozen from each hen, and if the farmer cannot attain that number, the fault is his own and not the hen's; and at that number the hen is made to pay a handsome profit on her keep.

Chickens should be raised in such quantities every year as to take the place of the old hens which should be sold every year; never keep your hens over two years, as the egg product is less each year while the risk of death is constantly increasing, and the hen depreciates in market value.

The poultry man has enemies. Lice and roup are the worst. By frequent use of liquid lice killer and insect powder, lice can be kept down. Roup is generally caused by drafts and crowding, dampness, lack of care, poor food, and filthy water. The symptoms are sneezing, wheezing, difficult breathing, eye-watering, rattling in the throat, discharge from the nostrils. There are reliable remedies if taken in time.

In feeding poultry, be careful not to feed too much; scatter the grain in straw or litter, so that the fowls will have to hunt every grain. The exercise will keep them healthy and they cannot eat too fast. Wheat is the best grain for poultry, but does not contain the right proportion of ingredients alone that the poultry should have. To feed a balanced ration that will satisfy the fowl and pay best, mill screenings are very good. A properly balanced mash should be fed at night. If you feed a mash in the morning your stock will gobble it up in a hurry and have nothing to do the rest of the morning.

If you feed it at night it warms up the fowl and it digests it while sitting on the roost. Raw meat ground and fed occasionally is good and you will get splendid results in eggs. Grit, shell, and charcoal should be before the stock at all times, especially when they are shut up. The grit grinds the food, so that it can be easily digested; the shell provides material for the egg shell; the charcoal purifies the blood. Some of you may think that sand and gravel will do as well. You may as well try to whittle a stick with the back of your knife, as to make gravel take the place of grit; gravel is round and does not cut the food; grit is sharp and cuts the food so that the fowl can thoroughly digest it. Fresh water must be given every day.

Some years ago when the poultry fever struck the country, and poultry shows were springing up like mushrooms, the predictions were that it would not last long. Such, however, has not been the case, but rather the reverse, and never in the history of our nation has the interest in poultry been more earnest than at this present writing.

Twenty years ago when I first visited the Annual State Fair of Minnesota, the poultry industry was then in its infancy. The entries were not over 400, but at last year's fair, over 2,000 entries came forward and the quality was of the very best to be found in the United States.

Then again I would call attention to the Minnesota State Poultry Association, another enterprise entirely separate from the state fair, which had an humble beginning in 1886, when the entries amounted to 200, the premiums were almost nothing. At the last exhibition held in Minneapolis January, this year, the entries numbered 2,000 and over \$2,000 were paid in cash premiums. The association has its own coops and everything necessary to the holding of the shows. There were exhibits from Illinois, Iowa, Wisconsin, North and South Dakota, and many birds changed hands at fancy prices. A Wyandotte cockerel sold for \$45.00; a Buff Cochin for \$75.00; a trio of Rhode Island Reds for \$25.00; \$60.00 was refused for a White Wyandotte cock.

It gives me great pleasure in presenting these facts concerning the state which formerly was my home, and to recommend the quality of the stock for which Minnesota is famous.

You can make money on eggs at 25 cents a dozen, and you don't need to sell them for less, as long as salt is so cheap; you

can salt them down for about two cents a dozen, and sell them when eggs are high. After you have got all the eggs you want for hatching, take your roosters from amongst your flock; the eggs then being non-fertile, will keep better.

We can increase our egg market here greatly, and get better prices. At present we are simply supplying the home trade, consequently our prices are low, while all the neighboring cities around us have been paying five cents a dozen more for eggs. If we had the eggs to ship, I say our prices would be better, as we can get better prices outside than we can get at home.

Broilers are also profitable and the market is unlimited if we could supply Butte and Helena, but we are looking on while poultry men in Nebraska and Kansas are shipping tons of poultry to these cities and pay three and four cents per pound freight, where it would cost us one and one-tenth cents per pound by express and 62 cents per hundred by freight.

We can raise more grain on an acre in Gallatin valley than any other country I know of, and I think we are in a position to raise poultry as cheaply as any state in the union. There is a great demand for capons in all markets and they bring higher prices than ordinary stock. Their flesh is very tender and much superior to ordinary poultry. A caponizing set with complete directions is not expensive, and the operation of changing cockerels to capons is one that can be performed with very little practice.

Ladies and gentlemen, in conclusion, we made a start ourselves in the direction of a poultry exhibit at our county fair and from our humble beginning, it will be hard to predict what our future may be; but let us be encouraged, our state is practically young and we have as fine a climate as any, and, I doubt if any better exists anywhere for poultry culture. Let us have an exhibit this year at our county fair that will be a credit to us all.

THE POULTRY BUSINESS.

By Rollie Scott, Red Rock, Mont.

But few people, especially in this western country, realize the importance of the poultry industry throughout the United States. For the benefit of those who have not been fully informed, an article from the "National Provisioner", recently published in a New York daily, states that the poultry industry of the United States last year exceeded in value all the gold and silver mined in the world during the same interval.

The number of stock fowls from which the season's crop of eggs and chickens were produced was 250,000,000 head. They furnished the market with eggs which were used for food direct to the value of \$144,000,000, and chickens worth \$130,000,000, combined making a total of nearly \$280,000,000.

The fact that the "National Provisioner" makes it a special duty to give nothing but reliable information, makes this report of especial interest to those engaged in poultry raising, as it surpasses the reports of all previous years, not only in number of eggs and fowls marketed, but in the price paid as well.

Success in poultry depends upon very much the same things that success does in any other industry; careless, extravagant habits must give way to painstaking, economical methods.

The Experimental Stations deserve great credit for the rapid progress made in the last few years. One cannot go wrong following the advice issued in their bulletins. They have given artificial incubation and brooding marked attention, and decided it was a vast improvement over the hen method.

At present I am operating four Cypher's incubators, which have a combined capacity of 110 dozen eggs. Last year, although I was handicapped by having to gather most of my eggs here and there among ranchers, I got fairly good results, and in the months of May and June hatched in the neighborhood of 1,500 chicks.

It is not necessary to build a house especially for a single incubator. Any dry, well ventilated cellar will do. After selecting a suitable place in which to operate an incubator, the next thing to be considered is the eggs. You cannot take a flock of fowls, brothers and sisters, which have been inbred for years, and expect to secure eggs that will hatch strong chicks. Thin shelled, irregular shaped eggs should never be set. The ex-

tremely large and small ones should also be culled out. Crushed burnt bones kept constantly before your hens will greatly reduce the per cent of poor shells and the charcoal contained will help to keep the fowls in a healthy condition. Have warm roosting quarters for your fowls, and a scratching shed. Fresh water and grit must be kept constantly before them. Wheat should form about one-third of the grain ration; green food of some sort, alfalfa hay about one-fourth inch lengths, steeped in boiling water, or cabbage, beets, rutabagas and potatoes. Meat should constitute not less than one-sixth the daily ration. If you have carefully selected, housed and fed your breeding stock, and hatched the eggs in a well made incubator, you now have a brood of strong, vigorous chicks. Twenty-four hours after they are hatched is soon enough to take the chicks from the machine. The first hatched will not starve and if you open the door and take them out before the hatch is over, or to help some unfortunate one free himself from the shell, you allow the moisture to escape which is very essential to a good hatch; besides a chick which cannot get out of the shell alone is seldom worth raising anyhow. On moving the chicks from the incubator to the brooder, which should have been running a day or two and is now at a temperature of 95 degrees, be especially careful and not chill them. A chill to young chicks means bowel trouble, which means short life. Some farmers who operate incubators do not use brooders at all, but set a number of hens when they do the incubators and divide the chicks equally among the hens. Any good sized motherly hen will care for 18 or 20 chicks. Several persons have made arrangements with me to get incubator chicks this summer which they are going to raise in this way.

The Leghorns, Plymouth Rocks and Wyandottes are the most popular breeds of the day. As to which of these breeds is the best it would be difficult to say. The Wyandottes are universally acknowledged as one of the best market fowls in existence. They are classed as an equal to the Plymouth Rock in laying qualities, and among my own flock are the best layers I have, and I am, as rapidly as possible, discarding all other fowls, to make a specialty of this breed.

We will now go back to the chicks from the incubator. It is often remarked that if you can raise them the first two weeks and have them strong and active at that age, the battle

is half won. No doubt the dry feeding is giving satisfaction among more people than any other method. The foods fed by a large majority of people contain too much fat-forming and not enough bone-forming elements; where a soft, easily digested food is used there is a tendency on the part of the chick's digestive organs to slight their work. The walls of the gizzard do not become hardened, but remain loose and flabby. Where a dry food is used which is composed mostly of cracked grains, the digestive juices are brought into action and the walls of the gizzard are given plenty of exercise, and a strong healthy chicken is the result.

I have been feeding my chickens with good results on a Johnnycake, composed of two quarts bran, two quarts cornmeal, two quarts ground oats, sifted, one quart finely cracked wheat, one quart finely cracked barley, two or three handfulls of ground beef, and a half dozen unfertile eggs from the incubator, crushed shell, and all, a double handful of good clean sand, and a heaping teaspoonful of soda, and a little salt. If the chicks have a tendency to bowel trouble I also add a cup of pure cider vinegar. This is thoroughly mixed with water, or sour milk if I have it, then baked in a slow oven from three to six hours, or until it is hard enough; I then pound it in small pieces and run it through a feed grinder. This is fed in the sand in a brooder for a few feeds, or until they catch on to what it is, then it is fed in litter a couple of inches deep made of cut clover hay.

This is the only food they get the first week, with plenty of fresh water to drink, and milk if you have it. They are fed four times a day and just what they will clean up each time. The second week goes very much the same as the first, only that once a day they should have a light feed of sliced raw turnips, beets or potatoes. If you haven't any of these vegetables and it is summer you can always get dandelions, which they will eat with a great relish. They should now have a mash of some sort once a day. To start with, it should be half bran; for the other half save out some of the mash you have prepared for the laying hens that day, stirring in the bran while it is hot, so as to scald it and make it more easily digested. To this add just a little cornmeal to give it more weight. By the end of three weeks, if they have done well, artificial heat will no longer be necessary as you have decreased the heat in the brooder one degree each day, and it is now down to 70. From now on they can be cared for very

much the same as the laying hens.

Just as soon as you can tell the Cockerells from the pullets they should be placed in colony houses, or brood coops, where they can have as free range as possible on a grassy run. By the end of five months, or along in October, if they were hatched in the spring, they begin to look quite like hens. Their heads are red, and they run about singing as though they were about to lay. It is now time to get them in winter quarters. This does not mean some old cabin where you can see daylight through the roof, but a good warm henhouse with a roosting room in which water will not freeze, except in extreme cold weather, and adjoining this house should be a scratching shed.

Next, do not crowd your hens. The old ones should be marketed, as they have almost stopped laying and begun molting. Fifty or sixty hens in a pen 15 by 20 feet will lay more eggs during the winter months than 75 in the same sized pen and under the same conditions. Every hen house should be equipped with a sand bath, a self-feeding grit box, dropping boards under the roosts, so the fowls can have access to the entire floor space, a feeding trough in which to feed the mash, plenty of nests, and see that they are kept clean and have lots of hay or straw in them, and a cage hanging on the the wall for breaking broody hens. This cage is a necessity where you hatch your chickens with incubators. When you go to close the house in the evening, always look for broody hens on the nests. If you find any, place them in the cage and do not give them anything but water for three days, then turn them out. It will take a couple days more for them to get filled up again and by this time they have forgotten all about setting, and in a week's time are back laying.

I have a laying house 100 feet long, which is divided into five 20-foot pens. In one pen I have 55 two-year-old hens and four roosters, which I save from year to year for breeding stock. Two of these pens have 55 May hatched pullets and four roosters each, and the remaining two have each 60 late-hatched June pullets, making a total of 300. I practically got no use of these pullets the fore part of the winter, as it was nearly Christmas before the building was completed, and they were out in colony houses up to this time. It was the middle of January before they were thoroughly accustomed to their new quarters and got

down to business. From that time down until this they have increased almost daily in the number of eggs laid, until now they have reached fourteen dozen and seven, or 175 eggs a day—an average of almost three dozen to the pen. One pen of May-hatched pullets, which are about half each of Wyandottes and Plymouth Rocks, has an average for the last two weeks of thirty-nine eggs daily. The June-hatched hens have been behind all along, but are now doing better than two dozen per day.

I have kept an accurate account of feed bills since January 1, and have discovered that it costs 75 cents a day to feed this flock, 15 cents to the pen or a quarter of a cent per day to the hen. Fourteen dozen eggs at 30 cents are worth \$4.20, or a net profit of \$3.45.

These fowls are fed a mash in the morning composed of one-fourth bran, one-fourth meat, one-fourth cut clover hay and rutabagas and one-fourth ground oats. The meat and rutabagas are boiled the day before, and after taking off the stove the clover is stirred in and allowed to cook in the steam. If the weather is cold, this is set on the stove a few minutes again in the morning and warmed. It is then dumped into the feed box, where the bran and oats are thoroughly mixed into it. The water and the cooked part of the mash is sufficient to soak the rest of it, as it must not be fed sloppy. At noon they get a feed of equal parts of cracked wheat and barley, with three or four beets or rutabagas to pick at. At night a straight feed of whole oats is given them, then after they go to roost about a pint of cracked barley is thrown into the litter of each pen to keep them busy while waiting for the mash in the morning.

All grain is fed in a litter of eight or ten inches of fine waste hay taken from the bottom of the feed mangers. Of course it is understood that they have fresh water, grit and burnt bone before them at all times.

Domestic Art.

"WHAT WE DO."

By Anna E. Hansen, Student of Short Course in Domestic Science. (1902.)

The attainment of a complete course in Domestic Science cannot be gotten in the course of nine months or even years, and a life time will seem scarcely sufficient to master the art to any great extent when one realizes its breadth.

We are looking forward to a time in the near future when every American woman will be learned in Domestic Science and thoroughly able to conduct her own work or her servants' in the easiest and most economical way. Our course this year has been very helpful and pleasant. It has consisted mainly of literature, art, sewing, and cooking, and household science.

Our literature has been very instructive and the notebook and class work have given us just enough of good literature to make us wish for time to enter into the study as deeply as we would like.

You have visited another department where the work is mostly industrial, though you probably would not think so from the name—the art department. It was here that we were first taught the mysteries of light and shade. In this department we have our regular period of study as well as in others, and we are always learning to feel our way into the work. We work in crayon, charcoal, pencil, and water-color. The greater part of this winter was given to designing and we made so many designs for doilies, sofa pillows and dress ornamentations that our teacher had her hands full to perforate and stamp them all.

Once a week we assemble in the art rooms to listen to a lecture, "art talk", our teacher calls it. This consists sometimes of a trip through Paris or Italy. We visit the studios of great artists; we see the sculptor at his work; we spend days in the great galleries filled with famous pictures and statues and often we find ourselves working in marble, bronze, wood, clay, or

plaster. And when all this is finished we are instructed in studio etiquette and many an amusing incident is told.

The art rooms are very interesting. Many drawings in all the different mediums are displayed upon the walls. You may see the casts, copies, and objects that we work from and so on through three large rooms till you come to another room the use of which puzzles you, as the furnishings are so different. This is the Japanese room. You look at the queer things, examining and admiring them till you come to a large glass case in which are some clay models that have been done by the pupils. You are shown some remarkable wood-carving and some decorated china, and these are also done by one of the students. When we get into our work we become very much interested and learn to love it. Very often our teacher sighs for millions to send her students East or to take them to Europe.

But now of our work in Domestic Science: Many people ask, "Is this work really practical or only theoretic?" I shall tell you what we do, and you will see that it is science applied to every-day needs.

In household economy we learn of the house and to make things clear, I shall build the Ideal House of which we so often speak.

We first select the location, not "any old place", but an elevated space and not in the march or lowlands. We examine the surroundings and see that no filthy barnyards or cesspools are in the near vicinity; we see that the view is pleasant, as the character of the surroundings has much to do with the character of the people. If you don't believe this just kindly take note of the fact and see what the result of your observation will be.

All things being favorable, we plan our Ideal Home. We lay the foundation not less than three feet and rarely more than six feet. If we do not have a cellar under all the house we see that places for ventilation are put in the foundation walls. Our cellar has windows on opposite sides to secure good ventilation and is about eight feet deep. We cement the cellar floor and walls to prevent dampness from entering. If we have to keep our dairy products and vegetables in the same cellar we erect a close partition to separate the two.

Our Ideal House is so planned as to give each room the sunlight at some time during the day. The plumbing system is

made to be as nearly vertical as possible and where it is of necessity horizontal, we see that there is a slight incline, and that all is airtight. This we test by taking an ounce or so of peppermint to the topmost trap and pour it down, after which we pour down a pail of water. We station some one below to detect the peppermint odors which circulate if the pipe is not airtight. If there is a leak be it ever so small, it may prove dangerous if not attended to at once.

All our furnishing of this house are of the most plain and durable material and still the most serviceable. The floors are oiled, and rugs in place of dusty carpets, are put upon them, and in fact in everything we are guided by a strict observance of health, economy, neatness, comfort and durability. But enough has been said on this subject and I will turn to other things.

The growth, manufacture and adulteration of spices, foods and beverages are all considered. We learn of the results of different experiments as to the food elements, the food itself, the purchase and manner of cooking and the best results practiced. We learn that the food a person takes should be regulated by the age and occupation of the person and the seasons of the year. We learn about the different cuts of meat, their value and the best way to cook and serve them; also of many other things too numerous to mention here. We learn of the simple home remedies for all ordinary aches, pains, bruises, and accidents and the means of possible prevention.

In cooking, during the first of the year, we were given a series of demonstration lessons by the teacher and we know just how to go at things without fear of spoiling them. In cooking we learn to make all kinds of dishes in the most palatable way and these dishes we serve in form of lunches to the students and members of the faculty.

All of this class have gotten a breakfast and a dinner, once with help, and once without help, as our examinations. We have each been hostess and waitress many times during the year and have given luncheon to the different basket ball delegations that have visited us. We plan our bills of fare, and count the cost to a cent of every luncheon, and best of all we learn of the economical uses of all "left-overs".

We have baked bread during the whole winter, both for our own use and for sale. Those who have had bread of us are very

sorry that they cannot get it always. Often as many as twenty-eight loaves of bread have been baked in one day.

The work in the sewing department has ranged from a sample book of all the different stitches, to coat suits and dresses. Our work for the first semester was to have been seven garments and many of us exceeded the number by twice the original. The second semester we made a lined suit, shirt waists, and our graduating dresses. All have completed the required amount and very much more.

If you have visited our sewing class you will have seen the garments made and the embroidery that has been done on them. This has been designed, perforated and stamped in the Art department and embroidered in the sewing class.

Most of us have done some upholstery in the way of covering dress boxes and making comfortable settees of them.

If you have visited our rooms you were struck with the home-like appearance. This is indeed so. They are not bare like most class work but make one feel at home in every way. Furnished comfortably and neatly with pictures and other ornamentations they are the most pleasant rooms in the building and we have enjoyed our work very much.

All this said, let me tell you of the results of our study and you will see that we are practical girls taking practical work.

For several months one of the girls in our class has made on Saturday all the bread for the family during the week. Another has finished her required amount of sewing besides doing almost half of that of her mother and sisters. Another has kept house for herself and two children besides doing her school work. One has supported herself in school and bought material for her practices by doing work in the way of Domestic Science. Another has successfully conducted a boarding club of about forty members, with board at not more than three dollars a week. And all of us have been able to do much work for ourselves and our mothers at home.

I am very sure that the class will agree with me when I say that this year has been the brightest and happiest that any of us ever spent in school and one we will never forget, and what is more, the benefit derived is lasting, practical, and one that can be improved on as the years go by.

THE DIGNITY OF HOUSEHOLD DUTIES.

By—————*

I deem it scarcely necessary to say that I am much pleased to have this privilege of coming before you at this important gathering of the representatives and friends of the agricultural, horticultural and other industrial pursuits of our state, as you may rest assured I think it an honor, especially when I consider the very important subject assigned me for an expression of a few thoughts; and should my paper not meet the expectations of some, you will please bear with me kindly, especially when you consider the scope of the subject; the many relations it bears to other subjects, and yet, how much of human happiness depends upon it. To the casual observer or superficial thinker perhaps the true dignity of household duties seldom, if ever, receive more than a passing thought—apparently unconscious of the fact that much that contributes to his weal or woe may be traced to she who presides over the duties of the household or home. Oh, that magic word “home”, that sends a thrill of delight through the human heart such as no other Anglo-saxon word can do, except it be “mother”. But they are inseparable; we can scarcely consider the one without the other. Yes, there is something sacred in “home”, no matter how humble, and the duties that appertain to that home are of vast importance, and when we consider how much they contribute to our happiness we certainly feel that she who performs the duties of the household or superintends their performance holds in our estimation a most dignified or worthy position.

Let us for a little while consider a few of these duties and the conditions favorable to their being performed so as to produce the best results.

Every intelligent housekeeper has a general or comprehensive knowledge of a home's requirements, what is absolutely necessary to contribute to the well-being of those who constitute the family. She sees that not only a knowledge of these requirements is necessary but to know how to reach the best results is still more essential. Among the many duties of the home perhaps none is of greater importance than the proper preparation of the food which we eat. It is an undeniable fact

* This paper was handed in by us of the deputation, but no name was signal to the paper, thus the blank.

that the health, morals, and family enjoyments are all closely connected with the question of cookery. I believe that Henry Ward Beecher's statement was no exaggeration when he said, "that it is an easy thing for a person to be a Christian whose stomach is in a good condition, but a most difficult thing for a dyspeptic." It requires no professional epicure to form a true estimate of a properly cooked meal. It contributes to good humor and good health, even though simple be the meal, if well dressed in its way. But a badly cooked meal is a waste—waste of money, and loss of comfort. A few years ago I saw a statement in a periodical that in the article of flour alone many millions of dollars were lost in making it into bread, and that loss was not only a matter of dollars but also a loss of health. But I will not enumerate other articles where similar loss is sustained in the matter of food preparation. But the question naturally suggests itself, how remedy this defect? I presume there is but one answer that can be truthfully given. Educate our girls; let cookery be made an ordinary branch of our daughter's education; let mothers do their part in this all-important matter, bearing in mind that in after years their ability to prepare a good meal will in a great measure determine their domestic happiness.

While I have a high estimate of music, mental culture and those accomplishments necessary for mental pleasure as well as to meet the social demand of the present day, yet, in my estimation, the art of properly cooking our food is preeminently first, at least from the standpoint of utility and economy. I do not think any one will question the position I take in regard to this all-important duty of the housekeeper, viz: A good knowledge of the art of cookery without which there cannot be the art of "living", which deserves a place among the fine arts, and which, perhaps, is in the front rank of the duties of the household in importance in regard to results. This thought is impressed more forcibly on my mind when I realize that the greater part of human labor is occupied in the direct production of the materials for our food. To utilize properly the products of human labor it is absolutely necessary that the housewife must be intelligent, industrious, methodic, systematic and economic, that the best results may be reached with the least possible waste of material intended to sustain life, and minister to the comforts and happi-

ness of the family and others who may be associated with her home.

I regret I cannot, from individual experience, consider to some extent some of those relations of the farmer's or rancher's wife to certain branches of industry with which she is more or less directly connected in the performance of her household duties. I, however, know something of the arduous and very responsible duties she has to perform requiring no low standard of intelligence directing and systematizing her work. Her keenness of insight, I believe, oftentimes enabling her to give material aid by her counsel to her husband in his industrial pursuits.

Another duty of the housekeeper which I wish to consider briefly is the necessity of making home as attractive as possible, which requires, in a measure, a certain amount of taste bordering, at least, on the artistic. Why should we not have pleasant things to look upon in our homes? There is no reason why the humbler classes should not surround themselves with evidences of beauty and comfort in all their shapes. The taste for the beautiful is one of the best and most useful endowments. It is one of the handmaids of civilization. Beauty and elegance do not necessarily belong to the home of the rich alone. How beautiful and cheap are flowers, and what a cheerful aspect they give a home. One of our greatest divines has beautifully said, "Flowers are among the most beautiful things God created into which He forgot to put a soul". Not only are they attractive, but also instructive and cannot help but have an elevating and ennobling influence on children as well as grown people. Some writer has said that their presence in a home is an index of culture. Again, pictures give us a taste for the beauty of art as they represent noble thoughts that may depict heroic acts, or may typify some beautiful scenes in nature which are means of education and self culture. In short, they make home more pleasant and attractive, sweetening domestic life, and shedding grace and beauty about it. Therefore I say that among the various duties of the household that which makes it attractive and pleasant is imperative on her who presides over it.

But in consideration of the brevity of the time in which I have had to prepare a few thoughts for this paper, but more especially on account of the pressure of my household duties I have been unable to prepare a more lengthy essay on this very important subject, hence I must pass to that which I believe to be preem-

inently the greatest and noblest of home duties. While it may not be considered such from an industrial standpoint, yet from educational and moral standpoints it is unquestionably so. It is one in which mother plays a principal part. It is a drama in which all humanity is deeply concerned. Mother's guiding, leading, and loving influence in the preparation of children for noble manhood and womanhood is the crowning act of home duties. She seems to realize that in her examples the habits of her children are molded after her habits; that her actual life becomes the model after which they unconsciously mold themselves, for example always speak more eloquently than words. The kind, loving Christian mother puts forth her best efforts to make the home of her children an abode of comfort, virtue and of happiness. She endeavors to make it the scene of every ennobling relation in family life that it may be endeared to them by many delightful memories; she looks on home as the training ground for young immortals, a sanctuary for the heart, a sweet resting place after labor, a consolation in sorrow, a pride in success, and a joy at all times. Yes, while it may be more in accordance with the spirit of such a meeting as this to discuss this subject in a manner having a close relation with the principles of economics, yet I believe that the greatest and noblest of a mother's duties in the home is the influence of her example in the formation of character in her children. Yes, she is the example and model constantly before their eyes whom they unconsciously observe and imitate. The pure and good thoughts she has implanted in their minds, when children, continue to grow into good acts long after her death, a memory of which causes her children to rise and call her blessed.

In view of these facts, who can fail to form a high estimate of the grand and noble, may I not say, sublime work of her who has charge of home; whose duties are not only dignified but beyond our power to form a true estimate of when the comfort and happiness of the human race are to be considered.

Miscellaneous.

EXPERIMENT STATIONS.

By Frank Spragg, Denton, Mont.

An agricultural experiment station is a group of scientists whose work is to investigate problems that the agricultural public need to know or have explained. Such member is a scientist specially trained to do a definite line of work. In general experiments, each one does the part that belongs to his own science. That we may understand what experiment stations are doing, we must look for a moment into the general educational system of the world. Before a student graduates from one of our colleges today, he is required to do some original research work. In so doing he may not extend the limits of knowledge, but prepares himself to do so in after life. Hidden away at the heart of almost every industry, and unknown to the busy world, toil these busy investigators to whom we owe our present wonderful civilization. Under the influence of the world's accumulated knowledge today, any man can spend his life in a single branch. In old age he will consider himself as a "little boy picking up the pebbles by the seashore while the expanse of the ocean spreads out before him". Yet, in the face of all this, we have just begun to discover nature's laws. Schools and colleges are to impart knowledge already obtained and give students the power needed for success. But in this progressive age we must not content ourselves with this. In the past, people have found out nature's laws by experience. Experience is a good teacher but it is too expensive for the individual. The experiences of experiment stations are published. It is not necessary for everybody to buy a lot of new seeds to find out whether they will do well. The station can do this. People have organized societies, that they may get together, talk over experiences, and plan to better their circumstances. Today we have hundreds of such societies belonging to any profession you might mention. We have stock

and wool grower's associations, horticultural, agricultural and like societies scattered far and wide over our land and throughout the world. The cardinal object of our own State Agricultural Society is to make "two blades of grass to grow where but one grew before". They aim to increase the production of the field, meadow, orchard, and garden; and yet preserve the primitive richness of the soil for generations unborn. They aim through irrigation and otherwise to turn as much as possible of our rich native soil into prosperous homes, and encourage every effort that will surround them with flowers and fruit trees or make them comfortable and cosy within, adding to the comforts, happiness, contentment, education, and refinement of the masses.

Comforts and progress beyond the dreams of our forefathers are being reached with the opening of the twentieth century. Investigation is now the watchword of the day, but the best organized system we have is that to be found in the work of the experiment stations. This work may be classified under five general heads: (1) They act as bureaus of information; (2) They devise better methods and introduce new crops, live stock and industries; (3) They aid the farmer in the contest against insects and disease; (4) They help defend him against fraud; and (5) They investigate the operations of nature in the air, water, soil, plants, and animals to discover principles for the improvement of the methods or products of agriculture. Stations are conducting a wide range of scientific research. Thirty stations are studying problems relating to meteorology and climatic conditions. Forty stations are at work on the soil. Fourteen stations are studying questions relating to irrigation. All stations are studying the more important crops: either with regard to their composition, nutritive value, methods of cultivation, and the best varieties adapted to the individual localities; or with reference to systems of rotation. All questions are being investigated with increasing relation to the requirements of the region in which the station is located. As an example, the present activity in plant breeding as distinguished from the indiscriminate testing of varieties, is a good specimen of the greater and greater efficiency of experiment station work as applied to directly practical ends. As greater knowledge and skill is attained by the specialist, he is enabled to so change the direction of nature's forces as to generate new varieties of plants

with special desirable characteristics. Thus the plant breeder makes up a list of the qualities desired, of a variety specially needed by the farmer of a given region, and applies all scientific knowledge and practical skill to the production of such a variety. For example, apple seeds may be planted here at the Montana station, and from the resulting new varieties, an apple obtained for this locality superior to anything heretofore known.

In the analysis of fertilizers, feeding stuffs, foods, and dairy products, and in testing of the purity and vitality of seeds, stations have done much to protect the people against fraud.

"A significant sign of the times is the growing disposition among farmers and stockmen to cooperate with the agricultural experiment stations of their respective states. In union of forces there is great strength. In no other way can the stations so effectively serve the people for whose benefit they were organized". Many cooperative enterprises are being carried on between the Bureaus of the National Department of Agriculture and the experiment stations, and new contracts are being formed for investigation on this plan. The department is interested in all questions of general interest to a group of states. In this way it becomes a central bureau, combining the efforts of the stations, and together they form one system of agricultural research. The world is being searched for the hardiest and most productive varieties of all farm crops best adapted to each individual locality. Stations in making tests are discovering the hardiest varieties of plants and telling farmers what is good to plant in varying localities and under varying conditions. Stations should be and are pioneers in this work. Then farmers do not need to depend upon seedmen, who may or may not be reliable.

That we may understand the way in which a question is investigated let us suppose it to be one of feeding. "What are the effects of different kinds of fodder, as hay, cornmeal, or bran, fed to the cow, upon the quantity and quality of the milk?" Or, "What feed should we use to make better pork at less cost?" Or, "What are the most economical rations for fattening steers or working horses?" To get answers to these questions the stations make actual tests by feeding the animals and noting the results. These tests differ from ordinary farm experiments in that they are more elaborate and accurate, in other words, more scientific. Successful feeding is not merely a matter of so much

hay or corn or turnips, but is a question of the nutritive ingredients which they contain and which the animal digests and uses to make blood, bone, muscle, fat, or milk, or uses as fuel to keep it warm and give it strength for work. The chemist of the station, with the apparatus in his laboratory, analyzes the material fed. That is to say, he separates the food into its constituent parts and finds just how much of each nutritive substance the animal consumes. Sometimes he weighs and analyzes the excrement, the undigested part, so that by comparing this with the food he learns how much of the whole food and of each ingredient the animal actually digests. In experiments with milch cows, the milk is likewise weighed and analyzed. In the case of fattening experiments, the animals are often slaughtered and the different portions weighed and analyzed. By such means, the effect of different kinds of fodder and methods of feeding and treatment are learned. A single experiment often requires the labor of several men for weeks or months. The same experiment has to be repeated again and again with different animals and under different conditions. So much does it cost to get reliable answers to the seemingly simple questions which farmers ask.

The future of our Montana station is very great. A ten year child, it now enters a new epoch of life. During the last year many of the old buildings have been moved; a new granary and machine shed built; and the dairy and heating plant finished. The near future will see the entire place cleaned up, and a large new cattle barn built west of the dairy. The college will then be able to vie with other institutions in its agricultural course. Montana is blessed with a congenial climate in which live stock thrives, and grain attains the largest yields known to the world. The native grasses are among the richest and most nutritious known. Maturing before the frost, they are good all winter. The soil is unsurpassed for fertility. Yet, with all our natural advantages our methods are crude. Unfinished products of many kinds are shipped east, completed and returned for Montana consumption. According to the freight bills of the various offices over the state, Montana produces 68 per cent, or about two-thirds of the flour she uses. From the same source we learn that 45 per cent of the eggs, 47 per cent of the poultry, 56 per cent of the butter, 92 per cent of the cheese, 95 per cent of the lard, and 98 per cent, or nearly all of the bacon and ham comes

from other states. What better arguments than these do we want to show the chances for the agriculturist, who will practice extensive methods of farming and make the best of his opportunities? Irrigation may be improved. I have seen valuable upland hay displaced by rushes and sedges, and grain turned yellow, actually drowned out. Perhaps at the same time a neighbor's crop down the stream was burning up. Again, the timber, the forest flood, the reservoir that nature has provided to store up the moisture in our mountains and distribute it gradually through the summer, has been nearly destroyed, burned up, chopped down and left to rot, or stolen by the capitalist. This must be remedied! Lately forest reserves have been made in some of our mountains, and a generation or two may overcome the loss of the past few years. The station has been measuring the streams, calculating losses of all kinds, determining the extent of the water supply, the area it is capable of using with judicious use, and the actual requirements of different crops under varying conditions. It is certain that with the aid of the State and National Governments the area now irrigated will be vastly increased and much alkaline land reclaimed.

Vast areas of our soil contain alkali, and in some localities arsenic and other waste products from smelters. We have large numbers of poisonous plants and infectious diseases that injure our stock, and insects that prey on our crops. The money-maker has put on our markets various compounds that sell for what they are not, and foods preserved by drugs that will preserve them not only against the germs of decay but against the digestive fluids of the stomach. The station is carrying on investigation along all these lines. It has analyzed a large number of soils, drinking and irrigation waters, and has been studying foods on the market for several years. An example of a compound found on the market as a strawberry preserve was as follows: Its color was due to a coal tar dye. The flavoring extract was an artificial product. The main mass was starch paste and the seeds when planted produced good timothy. On the line of poisonous plants, the station will now do a greater work than ever before, as Mr. V. K. Chestnut, the government expert in this line, became a member of the staff in February.

Up to a few years ago, only half of the agricultural land in Gallatin valley was actually in use each year, the other half being summer fallowed. It is a known fact that different plants ex-

tract different foods from the soil, and many crops generate food for other plants. Through the efforts of the station, many of the farmers now raise clover and fatten stock for the market, instead of summer fallowing. The station has proved that there is money in thus feeding stock, and will yet be able to show by experiment the money to be made by dairying. It will investigate the effect of different foods for the cow on the amount and quality of the product, and strive to discover the best methods of producing all that the market can ask in the way of butter and cheese. The station has exploded the idea that chickens need to live on grain alone; showed the profits to be made on the winter feeding of live stock for the market, investigated means for the destruction of insects injurious to fruits and other crops, and put on the market honey gathered by station bees.

The future questions for investigation in Montana will be varied and far-reaching. For an example, some of the future problems in irrigation will be to determine over a number of years what amount of water will give the greatest crop; secondly, to determine the greatest crop that can be obtained from a given amount of water. To illustrate, one and a half feet applied to an acre might give 45 bushels. Three feet might give a yield of 50 bushels. From this we see that had the three feet been applied to two acres, instead of 50 bushels 90 bushels would have been obtained. Another problem would be the relation of irrigation to changes in quality of crop in various ways. Again, under this subject, we might investigate the value of flood water on the deep bench lands and the kinds of plant that will give the best results without irrigation.

All the information acquired by the stations, and by the Department at Washington, by all means at their command, finds its expression necessarily in the form of publications. Thus, for general information on the results of agricultural investigation and improved methods, we must rely mainly on the publications of the stations, the Department of Agriculture, State Boards of Agriculture, and the agricultural press. All these publications and most of the bulletins published by foreign stations are received by the office of Experiment Stations at Washington. A brief, concise outline of these bulletins and articles is then published in the Experiment Station Record. The last number of this publication each year is an index for the year. When this and the other numbers of the year are bound together, we have

a volume. We now have fifteen volumes of the record. In agricultural libraries, like the one at the Bozeman Station, the bulletins of the stations are also bound up in volumes. We will suppose now that you wish to look up all the literature on the feeding of live stock. You would refer to the index in each volume of the record. It would refer you to the pages, on which mention was made of the bulletins on that subject printed during the year. Should you wish to know more than the article in the record told you, you could refer to the bulletin. Station bulletins are now distributed to half a million persons who are either farmers or closely identified with agricultural industries. Moreover, the work is discussed at farmer's institutes and in thousands of newspapers: a large correspondence is carried on with farmers, and the results of station work are taught to thousands of students in agricultural colleges.

The farmer's institute movement was started in farmer's societies about fifty years ago and is now held in 44 states and territories, including Hawaii. The century now closed has witnessed an intellectual awakening of the farmers of this country, the volume and depth of which have been rapidly increasing in past years. We now have a considerable body of well trained investigators, teachers, specialists, and other promoters of agricultural progress, who are working earnestly and with greater success each year to raise the general intelligence of farmers and give them accurate and definite information for the improvement of their practice. Farmers have not only been taught the general principles of science, and valuable lines of scientific research; but they have learned independence and the benefit of experiment. By aid of graduates from agricultural colleges, they have entered into active cooperation with stations. Stations have thus been enabled to show how a given grass, grain or vegetable yields in different parts of the same state, or the effect of a fertilizer on different soils. As all this is recorded and published in station bulletins, it becomes at once an addition to the world's knowledge.

So far, I have given a sketch of the development, work, and publications of stations, and aimed to outline the effect of this investigation in the material and intellectual development of the world. Time was when farmers made the rude tools they needed for the primitive practice of their art. Now the farmer employs implements and machinery which can be made only

with large capital and the highest mechanical skill, and by men who make the manufacture a business. So the experiments which he can make do not meet his needs today. Research, the finding out of nature's secrets, the discovery of the laws which underlie the right practice of agriculture, is costly. The more useful it is to be, the greater must be the outlay of money, labor, and scientific skill. Here, if anywhere, wise economy calls for the best.

But farmers have asked for and have received from stations more than help to improve their crops, and their cattle, and to make more money. They have felt the need of something higher and better for themselves, their wives, their children, their homes, and their profession. In the isolation and day by day struggle of farm life the opportunity for intellectual culture is all too small. Modern science reveals operations of nature in their strength and beauty, and lifts us by contemplation out of ourselves to higher things. It finds as much that is wonderful in the growth of a blade of grass as in the notions of the planets; as much of inspiration in the process by which a clod of earth gives up its fertility as in the forces that keep the stars in their places in the universe. In general, the outcome of station work will be vast and far-reaching. By systems of rotation in crops the soil will remain fertile from year to year. Through conservation of moisture, improved methods of irrigation, and new irrigation structures, the available water supply will continually increase and more and more land will be cultivated. Studies in the varieties of plants and animals will stock each farm with the best that the world can supply. Investigation in poisonous plants, diseases, and insect life enable us to maintain health in the plant and animal. Analysis of adulterated foods will give us laws insuring wholesomeness in what we eat. Horticulture and landscape gardening will enable us to enrich our homes. And general reflections on the laws of nature will elevate our thoughts and hopes and give us a view of higher things. It may be justly claimed that the United States has in its National Department of Agriculture and in the state experiment stations the most complete system of agricultural research in the world, and that the results obtained through these agencies have a wider application and have influenced to a greater extent the masses of the farmers than has been the case in any other country. The energy with which the experiment stations in the

United States have undertaken to bring the results of their investigations home to the farmer has excited the admiration of foreign leaders in agricultural progress. The system which we have adopted for frequent publication and wide distribution of station bulletins is without a parallel elsewhere".

"WHAT HAS THE FUTURE IN STORE FOR AGRICULTURE IN CASCADE COUNTY."

By Hon. Samuel Stephenson, Great Falls, Mont.

Mr. Chairman, and Ladies and Gentlemen: I am greatly pleased to have the privilege of being here with you tonight and to participate in these exercises. I feel at home in any meeting that is made up of farmers, because my father and all my brothers are farmers yet today, and I was raised upon a farm and worked until I was twenty-one years of age, and during the summer vacations during the time I was attending college. At my home in Great Falls I have a small farm in my back yard; and every summer I delight in taking my neighbors back there to display my vegetables and fruits and fruit trees and flowers, and I am often, when I get through making the display, reproached with the old saying that "my father spoiled a very good farmer to make a poor lawyer". (Laughter.) But I come before you tonight as a lawyer to speak of the future of agriculture in this county, because I recognize that the lawyers and the professional men and the merchants are vitally interested in the success of agriculture in this county and in this state. No one who can look over the history of the state of Montana can believe that we will make very great progress in the future except that progress coming from a wider development of the agriculture of this state, and no one who has been in Cascade county for eleven years, as I have been, and seen the changes that have come over this county during the past eleven years, can believe anything else than that there is a great wealth in the unbroken sods of this county and of all the northern counties of this state. And no one can study the different questions which are discussed in these meetings that are being held over the state and believe other than that today the farmers of this state have only just begun to develop the real agricultural resources of our soil. We are here upon the eve of a better

time. The agriculturalists of this county have had great obstacles to confront them, but we must not be unmindful that the pioneers of every state in this great union have had to meet the same obstacles in the same way that you have met them. I have often heard my mother tell that when they first settled in the woods of Indiana, that she used to go out and pick what they called goose-grass and dry it upon copper to make tea, and ground the grains of the barley to make coffee, and I have often heard her tell with what great pleasure my father used to bring from the county seat, perhaps once a year, a new calico dress to her. And when you compare the hardships that you have had to confront, in this new country with the hardships that the pioneers of the Middle States of this union confronted forty and fifty years ago; I believe that you will find that their hardships were greater than any hardships that you have had to meet. And yet, those people who settled there forty years ago, by thrift and economy, have all become more or less wealthy and have all become independent. Their wealth and independence was of but slow growth, but this steady saving as the years rolled by and the steady and certain increase in the value of the lands which they tilled, brought them in their old age a competency. And I want to say to every rancher who is here tonight that if you will go up on your ranch to live there and to make it a home, determined to put your efforts in its improvement, that, as sure as you are here tonight, it will leave you a competency in your old age. (Applause.) But you cannot farm upon horse-back; you cannot expect to go out to your ranch three months a year and go into town nine months a year to educate your children; you cannot expect to go upon a ranch and camp and make any success at ranching. The success in agriculture is of but slow growth. But until the ranchers of this county make up their minds that their ranch is their home, and that if they want better social conditions and better conditions in other respects, that they must make an effort to bring them to their ranches rather than leaving their ranches to go to town to get them, you are not going to make your ranch work the greatest success. Now, there are a great many people in this country who think that they have to move into town to educate their children. That may be true more or less. It may be necessary to send a boy or girl nine months to school in the city in order to make him an educated man. As far as I am concerned, I

never had the advantages of a city school, and it never was my privilege to attend a school more than six months in the year; but I believe that the advantages of raising boys and girls in the country, the fact that they are far removed from the vices that we find in all of our cities, the fact that they have nothing else to weigh upon their minds and divert their attention, are such that if you will have a reasonably good school teacher to teach them six months of the year out at your ranches, they will average up with the average boy and girl of the city, if you will do that thing. (Applause.) I want to call your attention, ladies and gentlemen, to the fact that some of the greatest minds and some of the greatest statesmen of this country came from the lowly cabins of our pioneer states, without the advantages of a city education, learning only what they could get from the books which they were able to borrow, attending country schools a few months in the year, but developing that independent character and that courageous spirit which the farm life of our country has ever had a tendency to develop. When they have gone out to battle with the world, they went with a moral courage, free from the vices that are incident to the cities, that made them stand up as men before their fellow men, even in the greatest strife for the greatest positions in this country. I want to say to you, gentlemen, that you ought to surround your ranches with every comfort that you can surround them with, that you ought to bend every effort and every energy to build up the neighborhood in which you live; you ought to set out fruit trees and grow small fruits; you ought to have fish ponds where you can have them; you ought to put up ice so that your wives can have ice in the summer, if it is necessary; you ought to surround yourselves with these little comforts so as to make your family and your children feel that they can be contented upon the ranches.

Now, there is another thought why we are all interested in building up an agricultural community, and that is this, that under the political conditions of this state today, it is almost essential that we have a greater agricultural population, because the farmer is the last man who is moved by corruption or lured from the paths of virtue; he is not driven to the primaries; he is not controlled by any corporation or any power at the polls; and I will tell you right now that Montana needs more independent voters and more independent men (applause) than she

has. We will get them when these fertile valleys of Cascade county and the counties north are peopled with an agricultural population. There is a great future for you gentlemen. The time is already upon us. This war with Russia and Japan will make you a market next year for your product; this Panama canal that is being built across the Isthmus of Panama is going to make the southern railroads reach up into this northwestern country to carry your wheat and produce down to St. Louis and New Orleans and to Galveston to load the ships for the Orient. You have great advantages and a great future before you. And I say it for you to go to your ranches, believing that you can make them homes and to stay with them and improve them, and accept the suggestions which you will receive from these gentlemen who have lectured to you this afternoon and who will speak to you further this evening. I am glad to know that you have so awakened to the great importance of these Farmers' Institutes. I trust that this is but the beginning of a long series of institutes which you will have here at Belt. I trust that you will attend them all and bring your neighbors, because I know that they will be of great benefit to you.

"THE STATUS OF THE DESERT LAND LAW."

By Joseph J. G. Burns, Belt, Mont.

Mr. Chairman, Ladies and Gentlemen: I will certainly not take up very much of your time this evening talking, as the program is very long, and furthermore for the reason that I have the driest question upon the program. (Laughter.)

Now, as you all know, on March 3, 1887, Congress passed a law enabling people to take up 640 acres of desert land. This was amended on March 3, 1891, cutting it down to 320 acres of land. Now, the object of allowing the people to take up this land as a desert claim instead of as a homestead, was that this was arid land in its natural state, and without placing water upon it you would be unable to cultivate this particular tract of land. They required, in order to take up this land, that you would flow over the land on each legal sub-division, water sufficient to cultivate one-eighth thereof. After congress had passed that law, small amendments, one after another, were enacted. Now in order to locate upon a desert claim, it is neces-

sary for you to make an affidavit showing that this land is desert in nature, that you have been over each and every legal subdivision thereof, and be supported by two witnesses who will testify to the same matter of fact. Now, what constitutes desert land is land that is arid in nature, not bordering upon any lake, river or running stream, saturated or irrigated by no natural stream of water, such as a spring or anything of that nature, and which in order to reclaim, or in order to irrigate, you must construct an artificial dam or an artificial ditch to conduct the water thereon. The law gives you a perfect right to take water out of any lake, natural flowing stream, spring, or further than that you can go to work and build a dam in a coulee upon your land, back up your water and conduct it over your land and use it as you deem necessary in order to produce an agricultural crop. The law used to require that each and every one who was producing an agricultural crop upon the desert land should cultivate and till one-eighth of the entire area thereof. Now the law has been changed by the Secretary of the Interior in his letter to the Hon. U. S. Commissioner at Washington, D. C., stating that where people, through a mode of irrigation constructed by them, were enable to produce a crop and increase the growth of natural grasses, it will constitute agricultural in nature.

After filing upon desert land, the next thing to do is to proceed to conform to what the law requires. The law says, in desert land propositions, that each and every one must expend at least one dollar per acre for each year for three years. You have, as you understand, in the first place paid 25 cents per acre upon the filing. Then you expend in labor one dollar per year for three years, or you can do all the work at once whenever you desire, so long as you do three dollars' worth of work per acre. The United States government is one of the most generous of governments to its people, because they allow you the greatest price for your work; they do not expect you to do your work for nothing, but they give you an agreed price for our work; for each rod of three-wire fence that you construct they allow you one dollar per rod; for each rod of ditch you construct, 12 by 24 inches, they allow you one dollar per rod; and if, in order to construct those ditches, it is necessary for you to go through rock, and it would be impossible for you to construct them for that dollar a rod, they still allow you more; then for breaking they allow you five dollars per acre; and all that they ask of you is

that you proceed to irrigate and reclaim this land from its arid state so that it may be used for agricultural purposes.

There is one rather strange proposition that the law requires, but nevertheless, my friends, it is true, that where you take water in order to reclaim your land, you are required to file a water right upon the land. That is the law. So, if there is upon one of the forties on which you have filed, or you may take the water out of a forty on your homestead which you own, but nevertheless the law says that you must proceed to file a water right upon that land. That is the law. So, if there is anyone within the hearing of my voice who does not understand that, it may be a benefit for him to know it before he proceeds to prove up on his land.

Another thing that they are fighting at the present time is the assignment of desert land entries. As far as the assignment of a desert land entry is concerned, I have nothing to say about it, because from the beginning I have never believed in the assignment of a desert land entry, that is, where you go into the land office or into my office and file upon a piece of land, you get your receipt, and the next day you give a quit claim deed to that piece of land, assign it over to somebody else, prove up on it, and you are gone away; you are not an actual settler, of course. That is one of the propositions that has brought about so much opposition to the desert land law. But there are times when the assignment is entirely correct and is right. It is the abuse and not the use of the assignment that is causing all the agitation today.

Now, in regards to contests. There is a matter that is of vital importance to a great many of our actual ranchers—I am not talking about “side-walk” farmers like Mr. Clingan and myself and a few more, but I am talking about actual ranchers—and that is this matter of contest. I know it from the records of my own office, that nine-tenths of the contests that are started, are started through pure spite. Now, for that very particular reason there has been formed here in Cascade county a society known as “The Farmers’ Protective Association”, and the object and aim of this association is simply to fight those contests. They have an executive committee that goes to work and looks into those contests as soon as a member is contested. If they find that he has conformed with the law and done his duty, then they

proceed to assist him, and if not, why, then they say that he is not eligible to any assistance at all.

The desert land law requires in the way of irrigation that you construct a ditch that will actually carry the water that you claim; it does not mean that you can walk down behind a plow and plow out a furrow and throw it out to one side, and come in before a United States Commissioner with two witnesses and say, "I have a ditch 12 by 24 or 8 by 12, whatever it may be, and say it carries so much water; it means it must be a **bona fide** ditch of that amount; it means also that when you construct a dam across a coulee for the purpose of holding water, that such dam will hold the amount of water you claim, and that you are able to run water for the number of days you claim in your final proof. You can go to work and construct a dam across a coulee; it does not make any difference how long it takes you; the government allows you dollar for dollar on that dam on your land.

ORGANIZATION AMONG FARMERS.

By John W. Pace of Helena.

The matter of organization among farmers has been touched upon several times in the remarks that have passed here today, and there seems to be an undercurrent of sentiment towards a unity among stockmen, land owners, farmers, producers, etc. I want to relate to you a little incident that impressed upon my mind very vividly the necessity of farmers getting together a little more. In Great Falls last month, when we attended the State Horticultural Society, there met in that city at the same time the annual meeting of the assessors; the assessors of every county in the state had a meeting there, and they agreed upon the valuation for the present year, the valuation that they would fix upon the various classes of property for taxable purposes. And being around the state a great deal I become acquainted by sight with a great many of the men who are engaged more or less in public work, and I noticed in Great Falls at that time that there as a representative there of every railway company in the state and every telegraph line in the state, and the telephone lines and of the larger corporations, and they consulted there for two days with those assessors regarding the values which should be placed upon the properties of their various interests; while the

farmers and stockmen of this county—the land owners alone represent something like \$110,000,000 of assessable property—there was not a man before that assessors' meeting to say one single word for the farmer; not a man, not a word. And every bit of reduction—I don't say the assessors were influenced at all by these gentlemen who appeared before them; I don't say anything of the kind, but I simply say to you that if there was a reduction in the valuation of the property represented by these various gentlemen—we have to raise so much money—and whatever reduction there was, increases the tax on the farmer. It has got to go somewhere, and the chances are it goes onto the land. Now that little incident impressed me very forcibly with the fact that the time had arrived when the land owners and farm producers of Montana should perfect and maintain an organization in this county and in every other county which would not only discuss those propositions, but would send representatives to a meeting like that to see that the valuation of lands and of livestock and of other property on the ranch should be assessed at a fair valuation, and no more, and that the larger influences should pay their just proportion of the taxes. Now, this little matter of taxation is only one of the many things that could be considered by an organization; it is just one of the many things.

This plan of organization has been perfected in other states. In Minnesota they have such organizations. I was in St. Paul late in December, and the preparations that were being made by the Minneapolis and St. Paul people to entertain the farmers, who held their annual meeting in those two cities, were on as large a scale as the preparations to entertain any other body of men that ever meet there. These men come down to St. Paul from all portions of Minnesota, and they have a larger influence upon the legislature than any class of people in the state; they have got so they consult the farmers in Minnesota now, just about as soon as they consult Mr. Hill. And you gentlemen ought to get together. I don't want to spread any feeling of discontent, because I believe that the man who spreads content is a nobler citizen than the fellow who makes people discontented; but I want to impress upon the mind of every landowner, stockowner and farm producer in the state of Montana that I conscientiously believe that the time is ripe for united organization, firm and busi-

ness-like, without any politics mixed in it at all, to simply take up these matters and to interchange ideas, and to promote those actions which will be for your mutual benefit and the protection of your various industries. And before we go away from here tonight I want to see a strong committee appointed in this meeting of representative farmers in this end of the valley to organize a local institute club, or whatever you want to call it, a club that can possibly hold meetings once in thirty days or sixty days, and where you men can get together and discuss taxation matters and every other matter that affects your interest, your property, and your markets or anything else. I want you to think it over carefully, to face the proposition squarely and see if you do not believe you can better your interests somewhat by a local, permanent, solid united organization.

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